WORK PLAN

ADDITIONAL DATA COLLECTION AT THE FORMER BULK CHEMICAL STORAGE AREA

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Prepared for
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SECTION ONE Introduction and Background

1.1 INTRODUCTION AND OBJECTIVES

This work plan describes the additional data collection activities to be performed at the solid waste management unit (SWMU) known as the former Bulk Chemical Storage Area (FBCSA) at the Solutia Inc. John F. Queeny Plant (Queeny Plant) located at 201 Russell Boulevard, St. Louis, Missouri. The general scope of additional data collection was initially discussed during an April 4, 2002 meeting at the Queeny Plant between attendees from U.S Environmental Protection Agency Region 7 (USEPA), Missouri Department of Natural Resources (MDNR), Tetra-Tech (on behalf of USEPA), Solutia Inc. (Solutia), and URS Corporation (URS, on behalf of Solutia). The purpose of the meeting was to discuss preliminary agency comments on the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Data Gap Investigation Report and to discuss the results of supplemental groundwater sampling conducted at the FBCSA (Solutia 2002). These investigations demonstrated that groundwater conditions in the FBCSA were highly variable (in terms of groundwater-surface water relationships and constituent concentrations). As a result, the potential effects associated with impacted groundwater discharging to the Mississippi River could not be fully understood. As such, it was discussed among the parties to conduct additional work at the FBCSA to address this issue. Additionally, the same parties met on July 30, 2002 to discuss the RCRA Environmental Indicators and the current status with respect to meeting these goals. For the CA-750 indicator (Migration of Contaminated Groundwater Under Control), it was agreed that additional information was needed. A letter dated August 2, 2002 from the USEPA reiterated the use of the additional data collection activities at the FBCSA to collect necessary data to meet the CA-750 indicator and to assist in the Corrective Measures Study.

The specific objectives of the work plan are to:

- Better understand the relationship between groundwater elevations at the FBCSA and river stage
- Better understand the dynamics of groundwater quality with varying groundwater elevations and river stage
- Better understand the extent of groundwater impact south of the FBCSA and east toward the river
- Assess the presence and extent of LNAPL and potential DNAPL

- Obtain site-specific soil and aquifer property data in order to refine the groundwater model to more accurately predict the migration of constituents to the Mississippi River
- Obtain additional receptor and habitat information and, based on the results of the above data collection, further evaluate potential ecological concerns
- Complete the CA-750 determination.

The above mentioned meetings and letters were considered in the preparation of this work plan. To better delineate the extent of impacted groundwater and potential effects to ecological receptors, the investigation will include: groundwater elevation gauging and sampling, constituent profiling, installation of piezometers and/ or monitoring wells, collection of soil samples, analytical testing, well surveying, groundwater modeling, ecological evaluation and data evaluation and assessment. This work will be conducted in accordance with the procedures and protocols in the agency approved Data Gap Work Plan (September 24, 1999) (including project Health and Safety Plan (HASP), and Quality Assurance Project Plan (QAPP)), approved URS modifications and amendments, or as described in this plan.

1.2 FACILITY LOCATION AND DESCRIPTION

The Queeny Plant is located in the western portion of the Cahokia, Illinois, U.S. Geological Survey (USGS) topographic quadrangle (**Figure 1**). The plant is located on the west bank of the Mississippi River at River Mile 178. The plant occupies roughly 63 acres; of this, approximately 58 acres are contiguous and are or were used for manufacturing. The remaining 4.6 acres comprises two properties that are located south of the main plant property. One of the two properties is the FBCSA, the focus of this work plan.

The Queeny Plant is located in an area that is zoned and developed for industrial and commercial uses and is expected to remain so for the foreseeable future. The site is proximate to a major transportation corridor provided by the Mississippi River, several interstate highways, and a large railroad center. **Figure 2** is an aerial photograph that shows the Queeny Plant in relation to the surrounding area. **Figure 3** shows the property owners surrounding the FBCSA.

The historical development of the riverfront near the plant involved the placement of man-made fills over the alluvial soils of the Mississippi River flood plain. The fill consists of bricks, slag, cinder, concrete, construction rubble, etc. in a matrix of sand and clay. A man-made levee

constructed by the United States Army Corp of Engineers (USACE) is located to the east of the property and protects the area from floodwater.

1.3 SWMU BACKGROUND

The FBCSA is a parcel of land approximately 285 ft by 300 ft, or approximately 1.94 acres. It was purchased in 1968 from Clark Oil Company and included two 500,000-gallon aboveground storage tanks and two 300,000-gallon aboveground storage tanks (ASTs) that were used for fuel storage by Clark. Raw materials used at the Queeny Plant were unloaded from a barge terminal, located on the west bank of the Mississippi River, and pumped into these tanks for storage. Materials stored at the terminal included: petroleum products, alkyl benzenes, blends of alkyl benzenes (Purex A-220 and Canadian A-221), Santicizer 154 plasticizer (p-t-butylphenyl diphenyl phospate), monochlorobenzene, ortho-nitrochlorobenzene, sodium hydroxide, and potassium hydroxide. The use of this area was discontinued in 1987 and the tanks were removed. This area was leased for a brief time to other companies for non-manufacturing purposes but is now under full Solutia control. The ground covering in this area is asphalt, crushed and compacted stone, and sparse volunteer vegetation. The FBCSA is located outside of the Queeny Plant main property and site security fence, but is enclosed by a locked security fence.

The photograph below depicts the FBCSA, looking east. The USACE floodwall can be seen in the background.

SECTION TWO Site Geology and Hydrogeology

2.1 REGIONAL AND SITE GEOLOGY

A significant amount of development has occurred along the riverfront over the past 200 years and the associated filling activities have raised the ground surface elevation and extended it eastward. These filling activities combined with the floodwall, which is immediately east of the property, has shifted the eastern edge of the flood plain east of the site. The surficial fill material consists mainly of clay, silt, sand and man-made debris. Underlying the surficial fill are glacial, alluvial, and colluvial deposits. The glacial material generally consists of gravel, sands, and silts, which are very dense to hard, originating as colluvial-fluvial materials deposited by meltwaters. The alluvial and colluvial deposits consist of interbedded sands, silts, and clays which were laid down on top of the glacial deposits by the current Mississippi River. Colluvial deposits were deposited concurrently with alluvial deposition at the flood plain margin. Underlying the unconsolidated materials is bedrock composed of the St. Louis Limestone Formation of the Paleozoic Era, Mississippian System Meramecian Series.

The general grain size of alluvial-colluvial deposits above the bedrock becomes coarser with depth, from clay to sand. Four stratigraphic units have been identified beneath the FBCSA (Solutia 2002). The upper fill unit is approximately 9 to 12 ft thick; and mainly consists of silty clay but also contains sand, gravel, cinders and other debris. Below the fill, is a relatively lower permeability fine-grained alluvial silt and clay unit with some areas of clayey silt and interbedded sand seams. The silty clay is generally gray and moist and extends to approximately 26 to 31 ft below the ground surface (bgs). The sand seams are usually water saturated and generally appear to be physically and hydraulically isolated. A sand unit underlies the silty clay and extends to bedrock. Bedrock was encountered in three boring locations at depths from 71 to 82 ft bgs. The sand unit consists mainly of fine to medium sand with some silt and coarse sand. This sand unit is generally water saturated through the entire thickness of the unit. During the September 2001 supplemental sampling event the upper approximately 5 ft of the sand unit was unsaturated. It appears that portions of the sand unit are unsaturated at times of low river stage.

2.2 SITE HYDROGEOLOGY

On a regional scale, groundwater flows characteristically from west to east from the main site area toward the major groundwater discharge feature of the area, the Mississippi River. The sand unit represents the major groundwater migration pathway due to its hydraulic properties (i.e., relatively thick and permeable).

SECTION TWO Site Geology and Hydrogeology

Groundwater at the FBCSA is encountered within two distinct water-bearing zones (Solutia 2002). The uppermost zone is within the fill and silty clay that together covers the entire site. The majority of the water in this zone is contained within the various sand lenses encountered in the silty clay, however, there are some zones of granular material in the fill that yield water. When separate, the units can only be contoured on a very local basis. This is due to characteristics such as the variable fill thickness and the silty clay unit being absent in certain areas and not containing water in certain areas. Locally at the FBCSA the silty clay is present, but varying water levels measured in the wells screened in the fill and silty clay during the Data Gap Investigation and September 2001 could not easily be contoured.

Minor or no communication between the groundwater in the fill and silty clay and the river was identified during correlation monitoring (O'Brien & Gere, 1999). At nested well locations, comparison of the potentiometric surface between wells screened in the fill and silty clay with those screened in the underlying sand shows a downward vertical gradient. The thin lenses of permeable material in the fill and silty clay unit are isolated and do not exhibit significant communication with the river, but likely serve as connective media with the underlying sand. Monitoring wells MW-24A, MW-25A, VW-1 and VW-2 are screened in this unit. **Table 1** shows completed information for the wells at the FBCSA. Boring logs and well construction diagrams are included in **Appendix A**.

The second water-bearing zone is the sand unit that underlies the FBCSA. The sand unit is generally confined by the overlying silty clay with depths to water ranging from approximately 20 to 24 ft bgs in wells screened in the sand (during the Data Gap Investigation sampling). Water levels were approximately 10 to 14 ft lower during the September 2001 supplemental event. At times of low river stage the sand is unconfined. The groundwater flow direction in the sand is generally east, toward the river as seen during the Data Gap Investigation. The sampling event during September 2001 showed a flat gradient with the river and/or a slight flow reversal from the river in some wells (indicating reduced discharge to the river).

In addition, evaluation of the communication between the sand unit and the river showed a positive relationship between river stage and groundwater elevation (O'Brien & Gere, 1999). A comparison of the potentiometric surface in wells screened at different depths in the sand unit shows very little vertical component, which indicates that flow is generally horizontal. This also indicates that the sand unit is the primary pathway for off-site migration and suggests that if any

communication with bedrock exists, it does not induce a vertical gradient with the sand unit. Monitoring wells MW-24B, MW-25B and VW-2B are screened in this unit. The boring log and well construction diagrams for Monitoring wells MW-24B and MW-25B are included in **Appendix A**. Logs for well VW-2B are not available.

SECTION THREE Scope of Work

3.1 DATA COLLECTION ACTIVITIES

This work plan describes the following primary data collection activities:

- Obtain groundwater and river stage information over time
- Obtain groundwater quality data over time
- Obtain groundwater quality data closer to the river
- Obtain groundwater quality data south of the FBCSA
- Conduct a light non-aqueous phase liquid (LNAPL) investigation around monitoring well MW-24A
- Obtain site specific soil properties data, to refine the groundwater model
- Assess potential dense non-aqueous phase liquid (DNAPL) near monitoring well MW-24B
- Obtain hydraulic conductivity data specific to the FBCSA
- Obtain additional readily available information on potential ecological receptors and habitats.

Table 2 summarizes the field data collection associated with these activities.

3.1.1 Obtain Groundwater and River Stage Information Over Time

The objective of this task is to obtain a better understanding of the relationship between groundwater elevations at the FBCSA and river stages over time. Automatic groundwater gauging equipment (e.g., pressure transducers) and dataloggers (e.g. Mini Trolls® or equivalent) will be placed in selected monitoring wells to obtain long term information (e.g., seasonal data). The data will be compared to Mississippi River stage information obtained by the USACE (http://lms61.mvs.usace.army.mil) as adjusted to the site.

Two dataloggers will be placed in wells screened in the fill/silty clay (MW-24A and MW-25A) and three dataloggers will be placed in wells screened in the sand (HW-1, MW-24B, and MW-25B). Both of the fill/silty clay wells are located in the FBCSA. Wells MW-24A and-25A were selected because they are screened solely in the fill/silty clay and screened at comparable elevations. Two of the sand wells are located in the FBCSA (MW-24B, -25B) while the other is

located in the former Coal Storage Yard (HW-1). These wells were selected because they are screened solely in the sand and screened at comparable elevations. The monitoring wells to be equipped with the gauging equipment and dataloggers are illustrated on **Figure 4**.

The dataloggers will be set to record frequent measurements (e.g., at least several per day). Dataloggers will be downloaded on a frequency appropriate for the number of measurements and logging capacity. The river stage data for the FBCSA will be recorded on a regular basis. The data will be extrapolated between USACE gauging stations on the Mississippi River located upstream and downstream of the FBCSA. The groundwater elevations will be plotted as time trend plots with the corresponding river stage. The wells and river stage will be monitored for approximately one year.

3.1.2 Obtain Groundwater Quality Data Over Time

The objective of this task is to better understand the relationships between groundwater quality at the FBCSA and varying groundwater elevations and river stages. Groundwater level measurements and samples will be obtained from the seven monitoring wells at the FBCSA. The monitoring wells to be gauged and sampled are illustrated on **Figure 5**.

The approximate schedule for the wells to be gauged and sampled is listed below.

Month	Wells and Designation	Monitoring Parameters
Month 1	Fill/ Silty Clay Wells (MW-24A, MW-25A, VW-1, VW-2) Sand Wells(MW-24B, MW-25B, VW-2B)	• VOCs • MNA Parameters
Month 3	Sand Wells(MW-24B, MW-25B, VW-2B)	• VOCs • MNA Parameters
Month 5	Fill/ Silty Clay Wells (MW-24A, MW-25A, VW-1, VW-2) Sand Wells(MW-24B, MW-25B, VW-2B)	• VOCs • MNA Parameters
Month 7	Sand Wells(MW-24B, MW-25B, VW-2B)	• VOCs • MNA Parameters
Month 9	Fill/ Silty Clay Wells (MW-24A, MW-25A, VW-1, VW-2) Sand Wells(MW-24B, MW-25B, VW-2B)	• VOCs • MNA Parameters

The wells screened in the fill and silty clay will be sampled during months 1, 5 and 9, and the wells screened in the sand will be sampled in months 1, 3, 5, 7, and 9. Samples will be analyzed for the Volatile Organic Compounds (VOCs) and certain Monitored Natural Attenuation (MNA) parameters listed in the Data Gap Work Plan (**Table 3**). The MNA sampling will consist of data obtained with field instruments (Conductivity, Dissolved Oxygen (DO), Iron (II), Oxygen

Reduction Potential (ORP), and pH) and data that is analyzed by the laboratory (Alkalinity, Chloride, Ethane/Ethene/Methane, Nitrates and Sulfates).

Prior to sampling, groundwater elevations (and the presence of any non-aqueous phase liquid [NAPL]), and total depth will be measured to the nearest 1/100 ft and documented using an electronic interface probe. The monitoring well information for the wells to be sampled, including screen intervals is summarized in **Table 1**. Each monitoring well will be purged until the temperature, specific conductance, and pH readings stabilize over a minimum of two successive well volumes after a minimum of three well volumes has been removed (or until the well is purged dry). The field parameters (temperature, pH, and specific conductance) will be measured and recorded on monitoring well development sheets during purging. The criteria used to determine stabilization is provided below:

- $\pm$ 0.25 units for pH
- $\pm$ 10% for specific conductance
- $\pm$ 1° C for temperature.

Field instruments will be calibrated prior to use in accordance with the manufacturer's specifications. The monitoring wells will be purged using either a conventional groundwater pump and polyethylene tubing or a disposable, polyethylene bailer. If NAPL is present, efforts will be made to collect water above or below the NAPL.

Groundwater samples will be collected using disposable, polyethylene bailers. Personnel conducting the groundwater sampling will wear clean disposable protective gloves. The bailers will be attached to new poly-rope and lowered slowly into the well to minimize agitation of the standing water. Samples will then be transferred from the bailer to the sample containers in a manner that minimizes agitation and aeration. Each sample container will be labeled with a sample identification number, site name, sampler's initials, date and time of sample collection, preservative, and the parameters to be analyzed. After sample collection, the samples will be logged on a chain of custody (COC) form, packaged to prevent damage during shipment, and placed in an iced cooler. The COC form will include the following information: project name and location, samplers signature, sample identification number, date and time of collection, sample type, and parameters to be analyzed. The groundwater samples along with the

corresponding COC form will be shipped to the specified laboratory in the QAPP, Severn Trent Laboratories ((STL) of Savannah, Georgia).

Laboratory data from STL will be provided in electronic and hard copy form. Hard copy data will be provided in Contract Laboratory Program (CLP)-like format. The additional data will be electronically loaded into the existing Microsoft Access®database. Analytical data from the sampling will be independently reviewed and validated by URS as outlined in the QAPP. The validation procedure to be used will be consistent with the USEPA guidelines for the validation of laboratory data (USEPA, 1993 and 1994).

Field personnel will wear USEPA Modified Level D personal protective equipment (PPE), with the potential to upgrade to Level C if site conditions warrant an upgrade. Health and safety related information will be primarily recorded in field log books or on monitoring well development sheets. In addition to the URS Health and Safety compliance, Solutia personnel will inspect the work areas and monitor the ambient air, as necessary, prior to issuance of a daily work permits.

The data from the field activities will be collected in accordance with procedures in the Data Gap Work Plan and QAPP as summarized below. Quality assurance samples in the form of duplicate, trip blank, matrix spike, and a matrix spike duplicate will be collected, as specified in the QAPP. Duplicates of selected samples will be collected to check for sampling and analytical reproducibility. Matrix spike and matrix spike duplicate (MS/MSD) samples will be collected and analyzed to evaluate the effect of the sample matrix on the accuracy of the analysis. Trip blank samples will be analyzed to assess VOC cross contamination of samples during shipment to the laboratory. One trip blank will be included in each sample shipment containing samples for VOC analysis. The trip blank will consist of one or more VOA vials prepared by the laboratory, transported to the field, and shipped with the other samples to the laboratory. The trip blanks will not be opened in the field. Trip blanks will be documented on the appropriate chain-of-custody forms for samples sent to the laboratory.

Field personnel and equipment will undergo decontamination procedures to ensure the health and safety of those present, to maintain sample integrity, and to minimize the movement of contamination between the work area and off-site locations. Non-disposable purging and sampling equipment will be decontaminated between each sample acquisition by washing with an Alconox® or equivalent detergent wash, a potable water rinse, and a distilled water rinse. Disposable sampling equipment, such as gloves, and bailers will be collected and bagged on a

daily basis and placed in 55-gallon, open-top steel drums for disposal. Personnel and small equipment decontamination will be performed at the sample locations. Decontamination and purge water will be transferred and containerized in polyethylene tanks and stored on location. Investigative Derived Waste (IDW) from the field activities will be managed in accordance with Solutia standard operating procedures for the Queeny Plant.

Solutia and URS will submit a Special Discharge Application request (along with supporting analytical data) to the St. Louis Metropolitan Sewer District (MSD) to discharge IDW related water. The approval would allow this material to be discharged at a controlled rate to the facility sewer (monitoring point 003).

3.1.3 Obtain Groundwater Quality Data Closer to the River

The objective of this task is to better assess the horizontal extent of groundwater impact from the FBCSA east toward the river. The groundwater in close proximity to the river will be vertically profiled for VOCs by collecting a discrete groundwater sample at approximately 15 ft intervals starting in the fill/silty clay (water saturated) to bedrock. This task will be completed at a time of average site flow conditions, as determined by the groundwater gauging and sampling, along with the river stage information that is collected for the FBCSA. Temporary piezometers will be installed in a minimum of three of the five locations for ongoing monitoring based on the profile results.

Vertical profile locations are shown on **Figure 6**. The five locations are positioned within and outside of the simulated 1 mg/l isoconcentrations line for chlorobenzene based on the modeling conducted for the Data Gap Investigation. The sampling points located inside the affected area serve two purposes. The first purpose is to gain a better understanding of groundwater quality downgradient of the FBCSA in the most affected area as predicted by the model. The second purpose is to better understand the vertical distribution of groundwater concentrations in the sand unit prior to discharge to the Mississippi River. The sampling points located on the periphery of the projected affected area were chosen to help assess the lateral limits of impact. The boring locations may be adjusted in the field dependent on the field layout, access conditions or results of previous borings. The possibility exists to have difficulty with the profiling due to riprap and large debris in the fill.

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The borings for the profiling will be advanced using a direct push technology (e.g., Geoprobe®). Soil samples will not be collected during this work. The Geoprobe® operates via a hydraulically powered percussion hammer that pushes 1-inch diameter steel sampling probes into the ground. The profiling will be conducted by driving a mill-slotted sampler (or equivalent) and stopping at approximately 15 intervals. Polyethylene tubing will then be placed down the inside of the probe rods to purge and retrieve a sample of the selected groundwater depth interval with a peristaltic pump or poly tubing with a check ball. Groundwater will be purged until a minimum of three tubing volumes has been removed. These samples will then be transferred to laboratory supplied jars for analysis. The samples will be taken to a local laboratory and analyzed for VOCs (via USEPA SW-846 Method 8260B) on an expedited turnaround basis. The sample handling and chain-of-custody procedures will follow those previously described in Section 3.1.2. At the end of profiling the holes will be grouted using tremie methods conforming to local, state, and federal requirements an/or requirements. The surface will be returned to its original condition.

The piezometers will be installed by conventional drilling techniques using hollow-stem augers. The piezometers will be constructed in accordance with state of Missouri guidelines by a permitted Missouri well driller. The piezometers will be constructed of 1-inch diameter schedule 40 polyvinyl chloride (PVC) casing and a 10-ft section of 0.010-inch slotted schedule 40 PVC well screen. A sand pack consisting of silica sand will be installed from the base of the piezometer to 2 ft above the well screen. During placement of the sand pack, the height will be checked periodically to ensure that the volume placed within the annulus correlates to the calculated volume required to fill the annular space. A bentonite seal with a minimum thickness of 3 ft will be installed directly above the sand pack. The remaining annular space will be filled with a cement/bentonite or high solids grout. The surface completion of the piezometers will include placement of a concrete pad, installation of locking caps and stickup or flush mount well covers, and placement of bumper posts, as necessary. Piezometer construction information will be documented on the boring logs, monitoring well construction diagrams, and well certification forms. All temporary piezometers will be registered with the MDNR Division of Geology and Land Survey in accordance with the Missouri Well Construction Code. The piezometers will be developed to remove the fines from the sand pack. The piezometers will be developed as discussed in Section 3.1.2, except for five well volumes will be removed instead of three. Piezometer development and purge water will be containerized and handled as discussed in Section 3.1.2.

A Missouri licensed surveyor will establish the horizontal and vertical locations of the piezometers and the ground elevations of the other sampling locations. Survey data will be presented in respect to site benchmarks. Locations may be surveyed via global positioning satellite (GPS) if sufficient accuracy can be obtained.

The piezometers will be gauged and sampled for VOCs in conjunction with the FBCSA monitoring wells during the subsequent sampling event. Groundwater samples from the newly installed piezometers and seven existing FBCSA monitoring wells will be collected using techniques previously described in Section 3.1.2. The sampling conducted during this month will serve as a baseline round of data for the FBCSA. The subsequent sample collection schedule for the piezometers will be the same as the sand wells at the FBCSA. At the end of the additional data collection periods, the temporary piezometers may be pulled and the holes will be grouted using tremie methods conforming to local, state, and federal requirements an/or requirements. The surface will be returned to its original condition.

The field activities (i.e., sampling, and IDW handling) and data management methods and procedures will follow those discussed in Section 3.1.2. Field personnel and equipment will undergo decontamination procedures as described above in Section 3.1.2. The hollow stem augers and the back of the drilling rig will be decontaminated prior to the drilling of each new borehole with a high-pressure hot water wash. The washing will be conducted on a dedicated decontamination pad located in an open area of the FBCSA. Decontamination fluids will be containerized and handled as discussed in Section 3.1.2. The IDW including PPE, will be handled as discussed in Section 3.1.2. Soil cuttings derived from the piezometer installations will be containerized in 55-gallon, open-top steel drums. The drums will be identified by marking reference information on the lid (e.g., boring number, drum contents, date filled, etc.). The drums will be profiled and staged for future disposal.

3.1.4 Obtain Groundwater Quality Data South of the FBCSA and Conduct a LNAPL Investigation around Monitoring Well MW-24A

The objective of this task is to gather shallow groundwater quality information from two locations located south of the FBCSA and to obtain information on the lateral extent of LNAPL around MW-24A. The groundwater south of the FBCSA will be vertically profiled for VOCs by collecting a discrete groundwater sample at approximately 15 ft intervals starting in the fill/silty clay (water saturated) to approximately 50 ft. Fifty-foot is below the depth of the highest detected groundwater concentrations collected during the profiling in the vicinity of MW-24B

during the Data Gap Investigation. The LNAPL around MW-24A will be investigated by initially installing three piezometers approximately 15-ft northwest, northeast, and south of MW-24A. The piezometers will be screened across the LNAPL zone as observed in MW-24A. The locations of the piezometers and vertical profile borings are shown on **Figure 7.**

The two profiling locations are positioned to the south of the FBCSA. The sampling points serve two purposes. The first purpose is to gain a better understanding of groundwater quality south of the FBCSA. The second purpose is to assess the potential for indoor air issues from dissolved constituents in the groundwater. The boring locations may be adjusted in the field dependent on access conditions. The vertical profiling of the groundwater will be conducted as discussed in Section 3.1.3.

The piezometers adjacent to well MW-24A will be installed using a direct push technology (e.g., Geoprobe®). Soil cores will be continuously collected with 2-inch diameter by 4-ft long Macro-Core® soil samplers with clear acetate liners. Soil samples will be visually evaluated for evidence of impact and screened in the field using a photoionization detector (PID). The installation of the temporary piezometers will be conducted as discussed in Section 3.1.3.

At the end of the installation, if LNAPL is measured, then an additional piezometer will be installed 10 ft further from the piezometer where the LNAPL was measured. This step-out process will be repeated until the LNAPL extent is determined. The piezometers will be left in place for a duration of time and will be measured periodically for LNAPL. At the end of the additional data collection the temporary piezometers will be pulled and the holes will be grouted as mentioned in Section 3.1.3. The surface will be returned to its original condition.

The field activities (i.e., sampling, and IDW handling) and data management methods and procedures will follow those discussed in Section 3.1.2 and 3.1.3.

3.1.5 Obtain Site-Specific Soil Properties Data and Assess Potential DNAPL

The objective of this task is to obtain soil properties (e.g., grain size, bulk density, and organic carbon) to help refine the site groundwater model and to address the USEPA concern for the potential of DNAPL near monitoring well MW-24B.

One boring is proposed near well MW-24B due to the maximum concentrations of chlorobenzene being seen in this well. One soil sample will be collected from the silty clay unit

and one sample will be collected from the sand unit for geochemical and physical properties. The boring will extend to bedrock to install a temporary piezometer to assess potential DNAPL. See **Figure 8** for the approximate boring location.

Samples will be collected using conventional drilling techniques with hollow-stem augers. Soil sample intervals will be predetermined based on the stratigraphy of well MW-24B. Soil samples from the boring will be collected and shipped to the URS Laboratory located in Totowa, New Jersey to be analyzed for:

- Total Organic Carbon (TOC) of the silty clay and the sand
- Permeability of the silty clay unit
- Grain size of the sand unit
- Porosity of the sand unit (measured indirectly)
- Bulk density of the silty clay and sand units.

If no measurable DNAPL is observed, a groundwater sample will be collected for VOC analysis. Sample collection and piezometer installation will follow the procedures described in Section 3.1.2. The field activities (i.e., sampling, and IDW handling) and data management methods and procedures will follow those discussed in Section 3.1.2 and 3.1.3.

3.1.6 Obtain Hydraulic Conductivity Data Specific to the FBCSA

The objective of this task is to obtain in situ hydraulic conductivity data from the seven wells at the FBCSA. The hydraulic conductivity data will help to refine the site groundwater model. The seven monitoring wells to be slug tested are illustrated on **Figure 9**.

Falling and rising head slug tests will be performed on the wells, using a slug of known volume and short-time interval, automatic water-level recorders. When the screen is not completely saturated only the rising head test will be performed. With the falling-head and rising-head slug test data, aquifer hydraulic conductivities will be calculated for the well. Measured groundwater gradients and calculated aquifer hydraulic conductivities will be used to determine groundwater flow rates.

The field activities (i.e., sampling, and IDW handling) and data management methods and procedures will follow those discussed in Section 3.1.2 and 3.1.3.

3.1.7 Obtain Additional Ecological Information

A review of readily-available ecological information will be conducted in order to supplement the information obtained during the Data Gap Investigation. The review will focus on obtaining relevant information on potential receptors and habitat in the site area. A review of ecological screening values may be conducted to determine whether existing values have been revised or whether additional sources of values are available.

3.2 DATA EVALUATION AND ANALYSIS ACTIVITIES

Following the receipt of all the data collected during the Additional Data Collection at the FBCSA Work Plan, the data will be evaluated and analyzed to address the following items:

- The nature and flow directions of groundwater from the FBCSA
- Better understand the dynamics of the two water-bearing zones and the river
- The presence and extent of LNAPL and potential DNAPL
- Refining of the groundwater model to more accurately predict the rate of migration and the concentration of constituents to the Mississippi River
- Update the assessment of potential ecological concerns based on data obtained under this work plan
- Complete the CA-750 determination.

3.3 DELIVERABLES

URS will prepare a report that summarizes the results of the work conducted. The deliverables will include documentation of the activities conducted, laboratory analytical results, figures, photographs, and conclusions associated with the work. The report is expected to include but not be limited to the following types of information:

- Results and conclusions of the continuous monitoring and gauging of the monitoring wells and piezometers at the FBCSA and near the Mississippi River
- Results and conclusions of the groundwater quality data south of the FBCSA
- Results of the LNAPL investigation and potential for indoor air issues
- Results of the revised groundwater model

- Results of the revised ecological evaluation
- Results of the DNAPL evaluation near Monitoring Well MW-24B.

Quarterly progress reports will continue to be prepared and submitted to the USEPA. The CA-750 environmental indicator form will be revised and submitted to the agencies.

3.4 SCHEDULE

This work plan will be implemented upon acceptance by USEPA. The overall schedule for this work is estimated to be approximately 14 months, based on the following primary data collection schedules (note some of these tasks may overlap)

- Mobilize upon approval of work plan (two months)
- Obtain access to non-Solutia property; work will begin when access agreements are obtained
- Obtain groundwater and river stage information over time (one year)
- Obtain groundwater quality data over time (nine months)
- Obtain groundwater quality data closer to the river (seven months)
- Obtain groundwater quality data south of the FBCSA (two months)
- Conduct a LNAPL investigation around Monitoring Well MW-24A, (two months)
- Obtain site specific soil properties data, to refine the groundwater model (two months)
- Assess potential for DNAPL near Monitoring Well MW-24B (one month)
- Obtain hydraulic conductivity data specific to the FBCSA (two weeks)
- Obtain additional ecological information (two months)
- Report preparation (two to three months).

SECTION FOUR References

Geraghty & Miller, Inc. November 1988. Assessment of Hydrogeologic Conditions at the Coal Storage Yard and Victor Street Terminal. Prepared for Monsanto Company.

Geraghty & Miller, Inc. March 1992. RCRA Facility Investigation, J.F. Queeny Plant. Monsanto Chemical Company, St. Louis, Missouri. Prepared for Monsanto Company.

Geraghty & Miller, Inc. June 1994. Phase II RCRA Facility Investigation. Prepared for Monsanto Company.

O'Brien & Gere Engineers, Inc. 1999. RCRA Facility Investigation Data Gap Work Plan. Prepared for Solutia Inc.

Solutia, 1998. RCRA Corrective Action Only Part B Permit Application.

Solutia, January 2002. RCRA Facility Investigation Data Gap Investigation Data Report: Groundwater Sampling at the Former Bulk Chemical Storage Area, John F. Queeny Plant. St. Louis, Missouri. Prepared by URS Corporation.

Solutia, July 2002. RCRA Facility Investigation Data Gap Investigation Report, J.F. Queeny Plant. St. Louis, Missouri. Prepared by URS Corporation.

Tables

TABLE 1
MONITORING WELL COMPLETION SUMMARY AND GEOLOGICAL STRATIGRAPHY OF THE SCREENED ZONE
FORMER BULK CHEMICAL STORAGE AREA

Monitoring Well Identification	Top of Casing Elevation (ft MSL)	Total Well Depth (ft btoc)	Bottom of Well Elevation (ft MSL)	Screened Interval (ft btoc)	Screened Interval Elevation (ft MSL)	Screened Stratigraphy
Fill and Silty Clay Wells						
MW-24A	420.80	28.10	392.70	(18.13-28.13)	(402.67-392.67)	Silty Clay
MW-25A	419.90	29.71	390.19	(19.97-29.97)	(399.93-389.93)	Silty Clay
VW-1	419.12	16.15	402.97	(6.00-16.00)	(413.12-403.12)	Fill/ Silty Clay/ Sand
VW-2	419.17	13.18	405.99	(6.00-16.00)	(413.17-403.17)	Fill/ Silty Clay
Sand Wells						
MW-24B	420.84	45.60	375.24	(34.56-44.56)	(386.28-376.28)	Sand
MW-25B	419.99	47.25	372.74	(37.70-47.70)	(382.29-372.89)	Sand/ silt lenses
VW-2B	419.55	76.81	342.74	(67.30-77.30)	(352.25-342.25)	Sand
Former Coal Storage Yard						
HW-1	423.13	47.79	375.34	(32.00-47.00)	(391.13-376.13)	Sand
HW-1B	422.40	79.56	342.84	(70.15-80.15)	(352.25-342.25)	Sand

Notes:

1.) MSL=Mean Sea Level

2.) btoc= below top of casing

3.) The total well depths shown on the table were measured in September of 2001.

TABLE 2
SUMMARY OF ADDITIONAL DATA COLLECTION ACTIVITIES
FORMER BULK CHEMICAL STORAGE AREA

Task	Generalized Scope of Additional Data Collection	Sample Testing
1. Obtain Groundwater and River Stage Information	• Install dataloggers in 2 fill/silty clay wells and 3 sand wells. • Obtain river stage information (from COE) • Monitor for 1 year	None planned
2. Obtain Groundwater Quality Data Over Time	• Collect groundwater samples from 4 fill/silty clay wells during months 1, 5, and 9 • Collect groundwater samples from 3 sand wells during months 1, 3, 5, 7, and 9	• VOCs, monitored natural attenuation (MNA parameters)
3. Obtain Groundwater Quality Information Closer to River	• Conduct vertical profiling at 5 locations; sample groundwater at 15 ft intervals to bedrock • Drill and install temporary piezometers at a minimum of three locations. • Sample piezometers at same frequency as sand wells in Task 2	• VOCs • VOCs
4. Data Collection South of FBCSA and LNAPL Extent Around MW-24A	• Conduct vertical profiling at 2 locations south of FBCSA; sample groundwater at 15 ft intervals to 50 ft. • Install 3 temporary piezometers around MW-24A; manual gauging for LNAPL	• VOCs • None planned
5. Obtain Soil Properties Data and Assess Potential DNAPL at FBCSA	• Drill boring adjacent to MW-24B to bedrock. • Collect one soil sample from silty clay and one soil sample from sand unit for physical and geochemical properties testing. • Install temporary piezometer; manual gauging for DNAPL. Collect groundwater sample if no DNAPL present.	• Silty clay – TOC, permeability, bulk density • Sand – TOC, grain size, porosity, bulk density • Groundwater – VOCs
6. Obtain Hydraulic Conductivity Data	• Conduct slug tests on 7 wells at FBCSA	None planned
7. Obtain Additional Ecological Information	• Conduct literature-based review of available receptor, habitat and screening value information	None planned

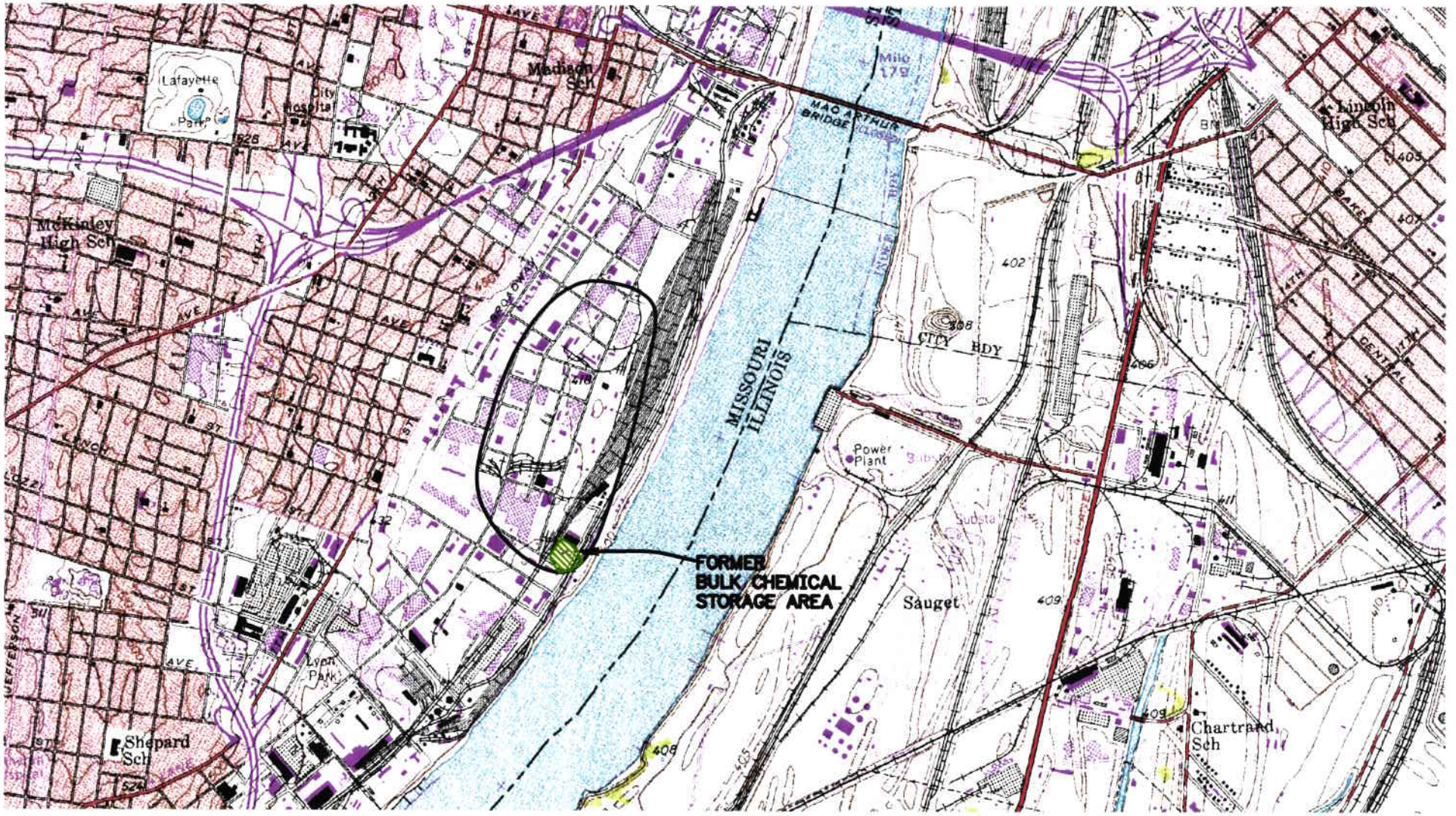
Note: refer to work plan text for specific information, e.g., identification of wells, number of samples, etc.

TABLE 3
ADDITIONAL DATA COLLECTION AT THE FBCSA CONSTITUENT LIST

Volatile Organic Compounds	Natural Attenuation Parameters
	Field Analysis
Acetone	Alkalinity
Benzene	Chloride
Bromodichloromethane	**Conductivity**
Bromoform	**Dissolved oxygen**
2-Butanone (MEK)	Ethane
Carbon tetrachloride	Ethene
Carbon disulfide	**Iron (II)**
Chlorobenzene	Methane
Chloroform	Nitrate
Chloromethane	**Oxidation-reduction potential (eH)**
Dibromochloromethane	**pH**
1,2-Dichloroethane	Sulfate
cis 1,2-Dichloroethene	**Temperature**
trans 1,2-Dichloroethene	Total Organic Carbon (TOC)
Ethyl methacrylate	**Turbidity**
Ethylbenzene	
Iodomethane	
4-Methyl-2-pentanone (MIBK)	
Methylene chloride	
Tetrachloroethene	
Toluene	
1,1,1-Trichloroethane	
Trichloroethene	
Vinyl chloride	
Xylene	

Figures

File: E:\21560870.00013\SITE MAP.DWG Last edited: JAN. 14, 03 @ 12:44 p.m. by: DJDEGUIO



LEGEND

— GENERAL LOCATION OF J.F. QUEENY PLANT

FORMER BULK CHEMICAL STORAGE AREA

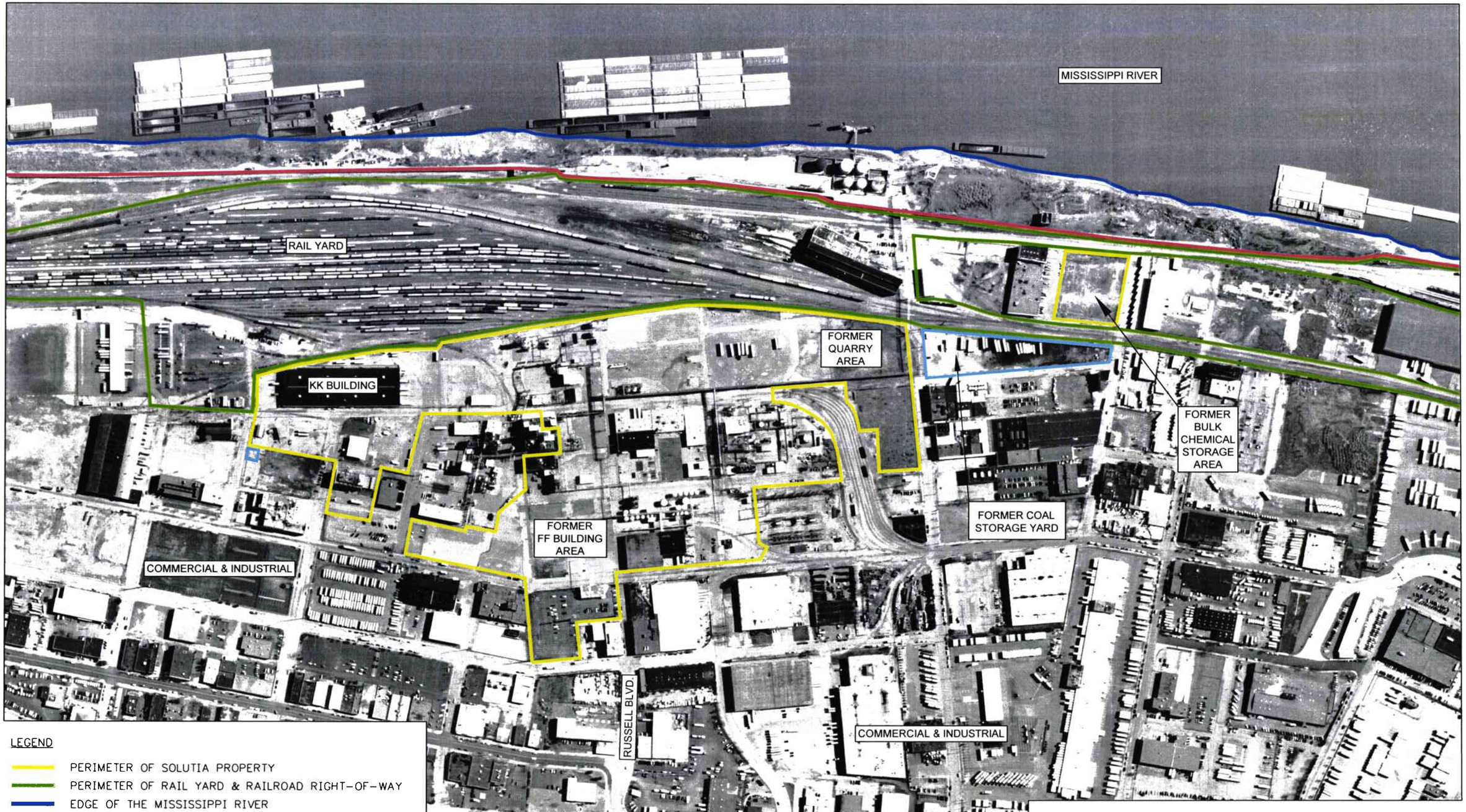
BASE MAP REFERENCE: MAP TAKEN FROM ELECTRONIC USGS DIGITAL RASTER GRAPHIC 7.5 MINUTE SERIES TOPOGRAPHIC MAP OF CAHOKIA, ILLINOIS, REVISED 1952.

N

0 2000

SCALE FEET

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT THE FBSCA WORK PLAN J.F. QUEENY PLANT ST. LOUIS, MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY: djd 12/30/02 DSGN. BY: tja CHKD. BY:	Site Location Map	FIG. NO. 1



LEGEND

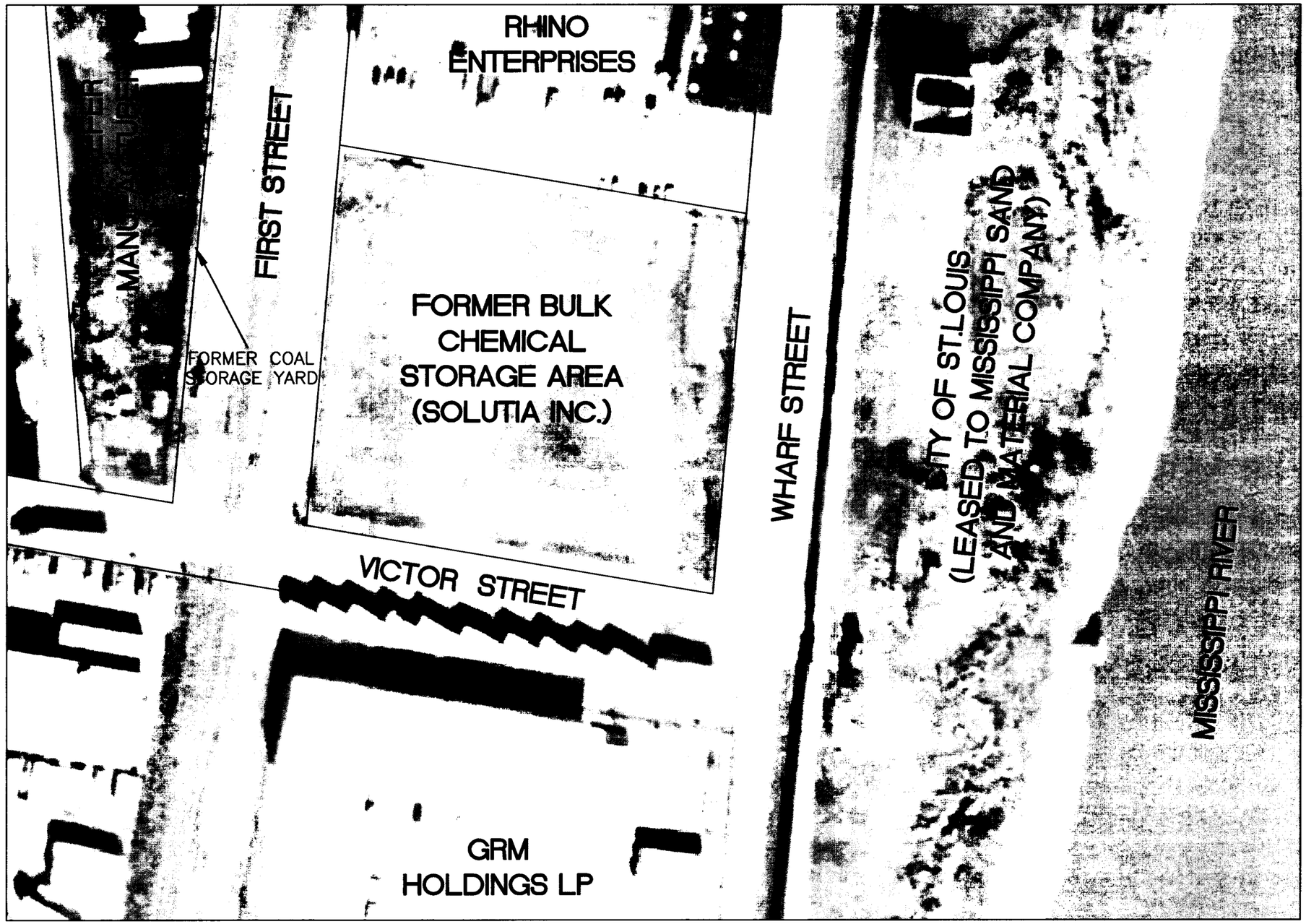
- PERIMETER OF SOLUTIA PROPERTY
- PERIMETER OF RAIL YARD & RAILROAD RIGHT-OF-WAY
- EDGE OF THE MISSISSIPPI RIVER
- U.S. ARMY CORPS OF ENGINEERS FLOODWALL
- RFI DATA GAP ACTIVITIES ON NON-SOLUTIA PROPERTY

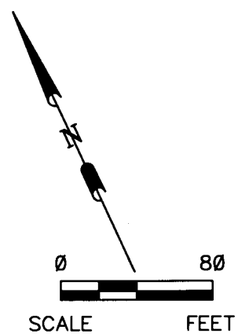
APPROXIMATE SCALE: 1IN. = 400FT

SOURCE: SURDEX AERIAL PHOTO, FLOWN APRIL 6, 2002

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT THE FBCSA WORK PLAN J. F. QUEENY PLANT ST. LOUIS MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY:djd 12/30/02 DSGN. BY:tja CHKD. BY:	J. F. Queeny Plant Aerial Photograph	FIG. NO. 2

File: E:\21560870.00013\AERIAL FIG_2.DWG Last edited: JAN. 14, 03 @ 12:45 p.m. by: DJDECUIO

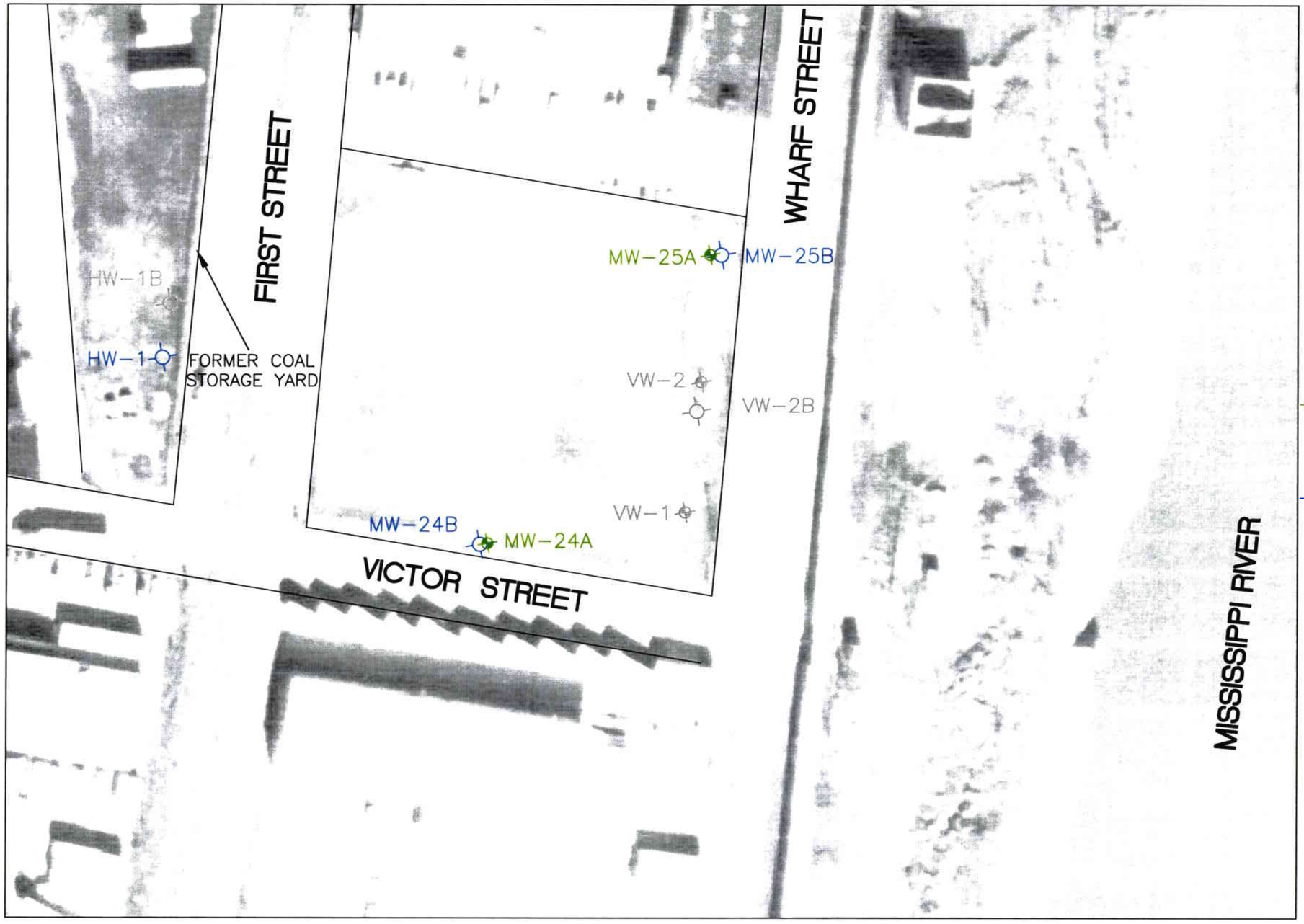




SOURCE: SURDEX AERIAL PHOTO, FLOWN APRIL 6, 2002

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT FBSCA WORK PLAN J. F. QUEENY PLANT ST. LOUIS MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY:djd 12/30/02 DSGN. BY:tja CHKD. BY:	FBCSA Surrounding Property Map	FIG. NO. 3

File: E:\21560870.00013\FIG-3.DWG Last edited: DEC. 30, 02 @ 12:23 p.m. by: DJDEGUIO



LEGEND

- MW-25A WELL SCREENED IN THE FILL & SILTY CLAY WITH GAUGING EQUIPMENT AND DATALOGGERS (MW-24A AND MW-25A)
- MW-24A WELL SCREENED IN THE SAND WITH GAUGING EQUIPMENT AND DATALOGGERS (HW-1, MW-24B AND MW-25B)

N

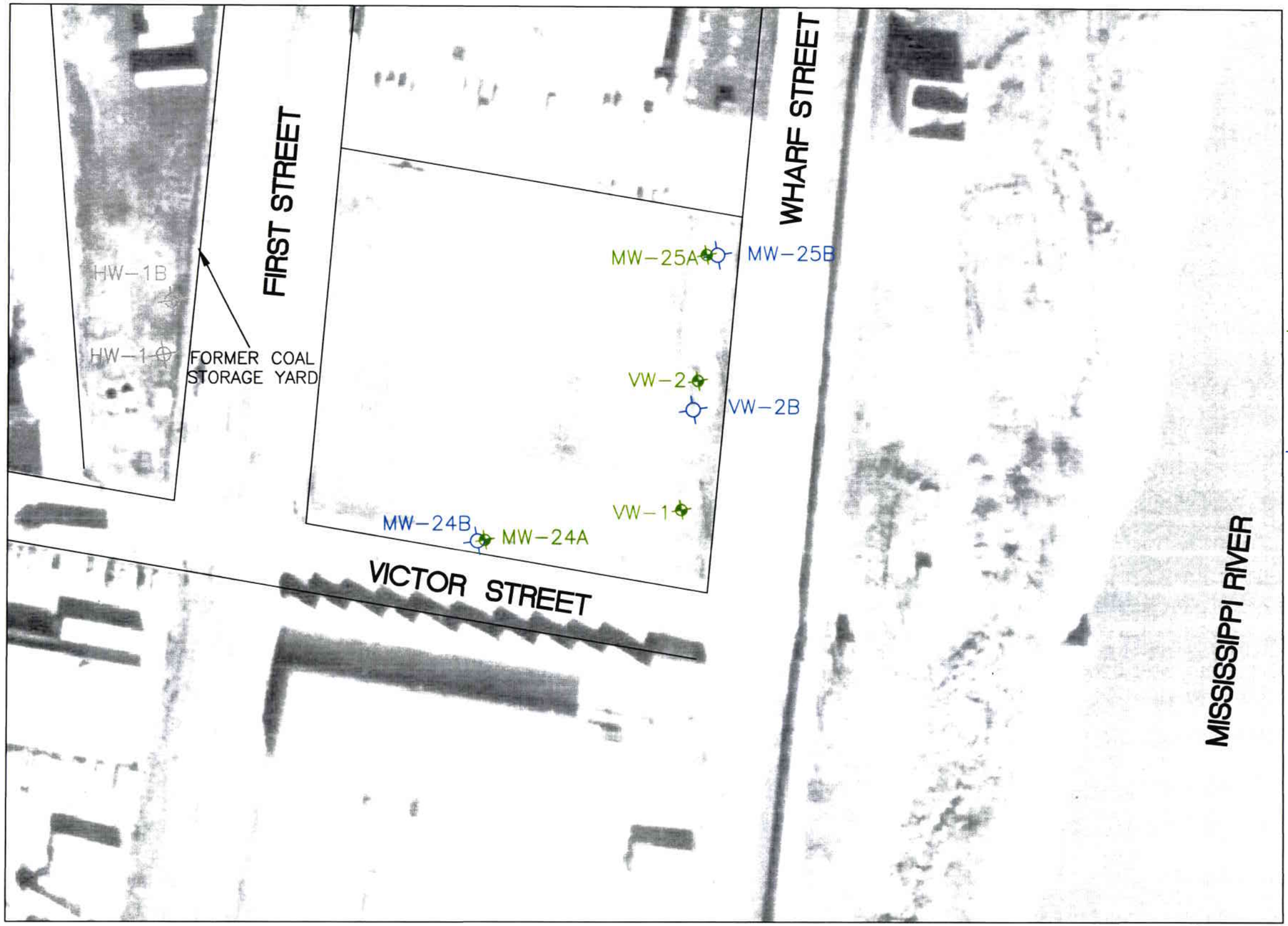
0 80

SCALE FEET

SOURCE: SURDEX AERIAL PHOTO, FLOWN APRIL 6, 2002

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT THE FBSCA WORK PLAN J. F. QUEENY PLANT ST. LOUIS MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY: djd 12/30/02 DSGN. BY: tja CHKD. BY:	Monitoring Wells with Gauging Equipment and Dataloggers Location Map	FIG. NO. 4

File: E:\21560870.00013\FIG-4.DWG Last edited: DEC. 30, 02 @ 12:21 p.m. by: DJDEGUIO



LEGEND

MW-25A WELL SCREENED IN THE FILL & SILTY CLAY TO BE GAUGED AND SAMPLED (MW-24A, MW-25A, VW-1 AND VW-2)

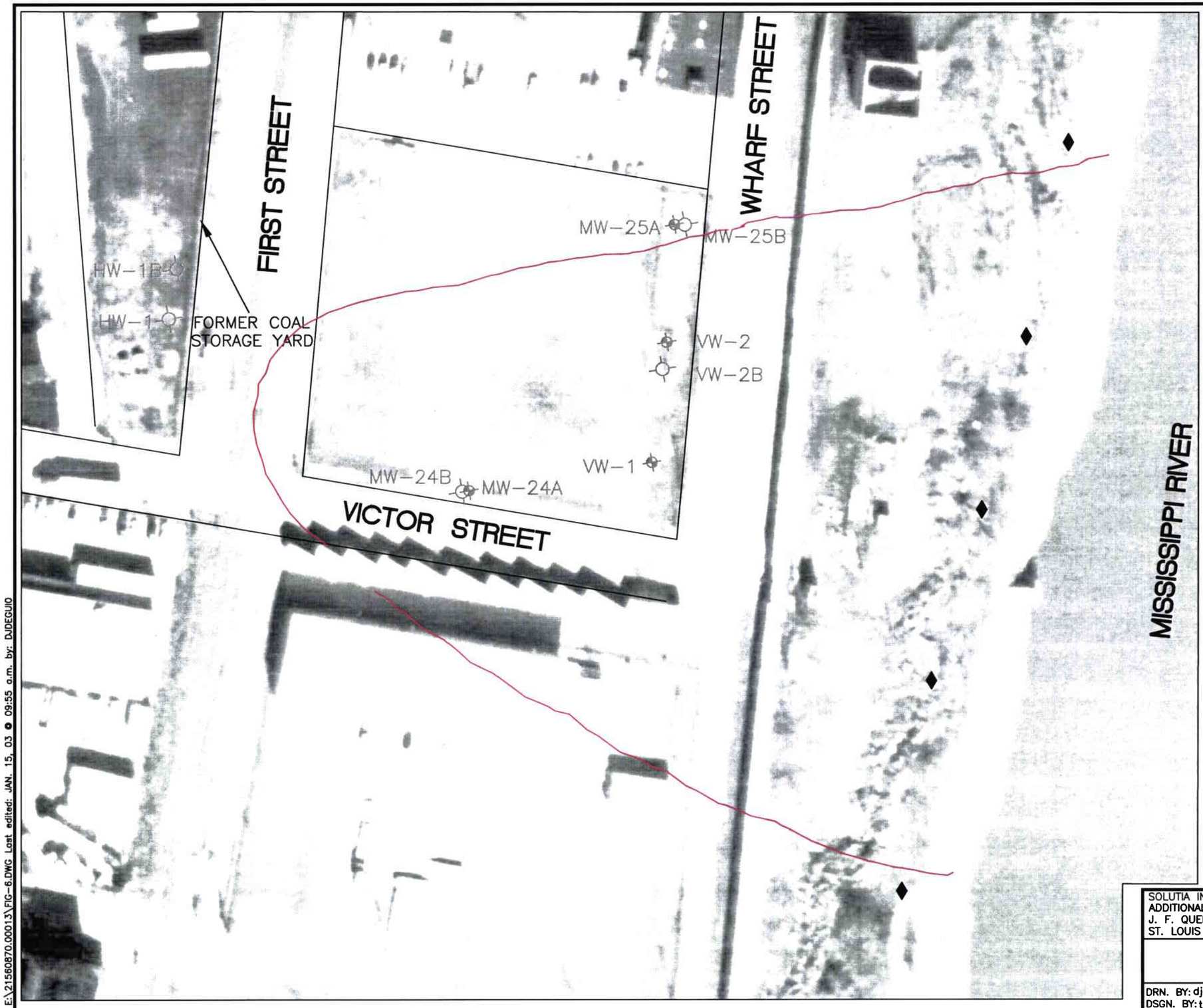
MW-24A WELL SCREENED IN THE SAND TO BE GAUGED AND SAMPLED (MW-24B, MW-25B AND VW-2B)

Ø 8Ø
SCALE FEET

SOURCE: SURDEX AERIAL PHOTO, FLOWN APRIL 6, 2002

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT THE FBSCA WORK PLAN J. F. QUEENY PLANT ST. LOUIS MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY: djd 12/30/02 DSGN. BY: tja CHKD. BY:	Monitoring Well Location Map of Wells to be Gauged and Sampled	FIG. NO. 5

File: E:\21560870.00013\FIG-5.DWG Last edited: DEC. 30, 02 @ 12:15 p.m. by: DJDEGUIO



LEGEND

- ♦ PROPOSED LOCATION FOR GROUNDWATER PROFILING (A MINIMUM OF THREE OF THE FIVE LOCATIONS WILL BE CONVERTED TO TEMPORARY PIEZOMETERS BASED ON PROFILING RESULTS)
- EXTENT OF CHLOROBENZENE TO 1 PPM IN THE SAND. THE EXTENT WAS SIMULATED WITH MODELING

N

Ø 8Ø

SCALE FEET

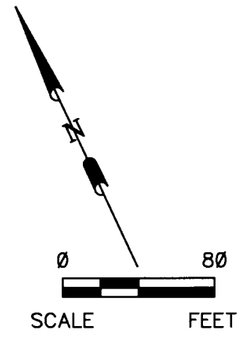
SOURCE: SURDEX AERIAL PHOTO, FLOWN APRIL 6, 2002

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT THE FBSCA WORK PLAN J. F. QUEENY PLANT ST. LOUIS MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY: djd 12/30/02 DSGN. BY: tja CHKD. BY:	Proposed Locations for Groundwater Profiling (To the East)	FIG. NO. 6

File: E:\21560870.00013\FIG-6.DWG Last edited: JAN. 15, 03 @ 09:55 a.m. by: DJDEGUIO

LEGEND

- PROPOSED LOCATION FOR GROUNDWATER PROFILING
- PROPOSED LOCATION FOR TEMPORARY PIEZOMETER TO GAUGE LNAPL



SOURCE: SURDEX AERIAL PHOTO, FLOWN APRIL 6, 2002

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT THE FBSCA WORK PLAN J. F. QUEENY PLANT ST. LOUIS MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY: djd 12/30/02 DSGN. BY: tja CHKD. BY:	Proposed Locations for Groundwater Profiling (To the South) and LNAPL Investigation	FIG. NO. 7

File: E:\21560870.00013\FIG-7.DWG Last edited: JAN. 14, 03 @ 1:08 p.m. by: DJDEGUIO

LEGEND

▲ PROPOSED LOCATION OF SOIL BORING FOR SOIL PROPERTY TESTING (THE BORING LOCATION WILL BE CONVERTED TO A TEMPORARY PIEZOMETER TO EVALUATE POTENTIAL DNAPL)

N

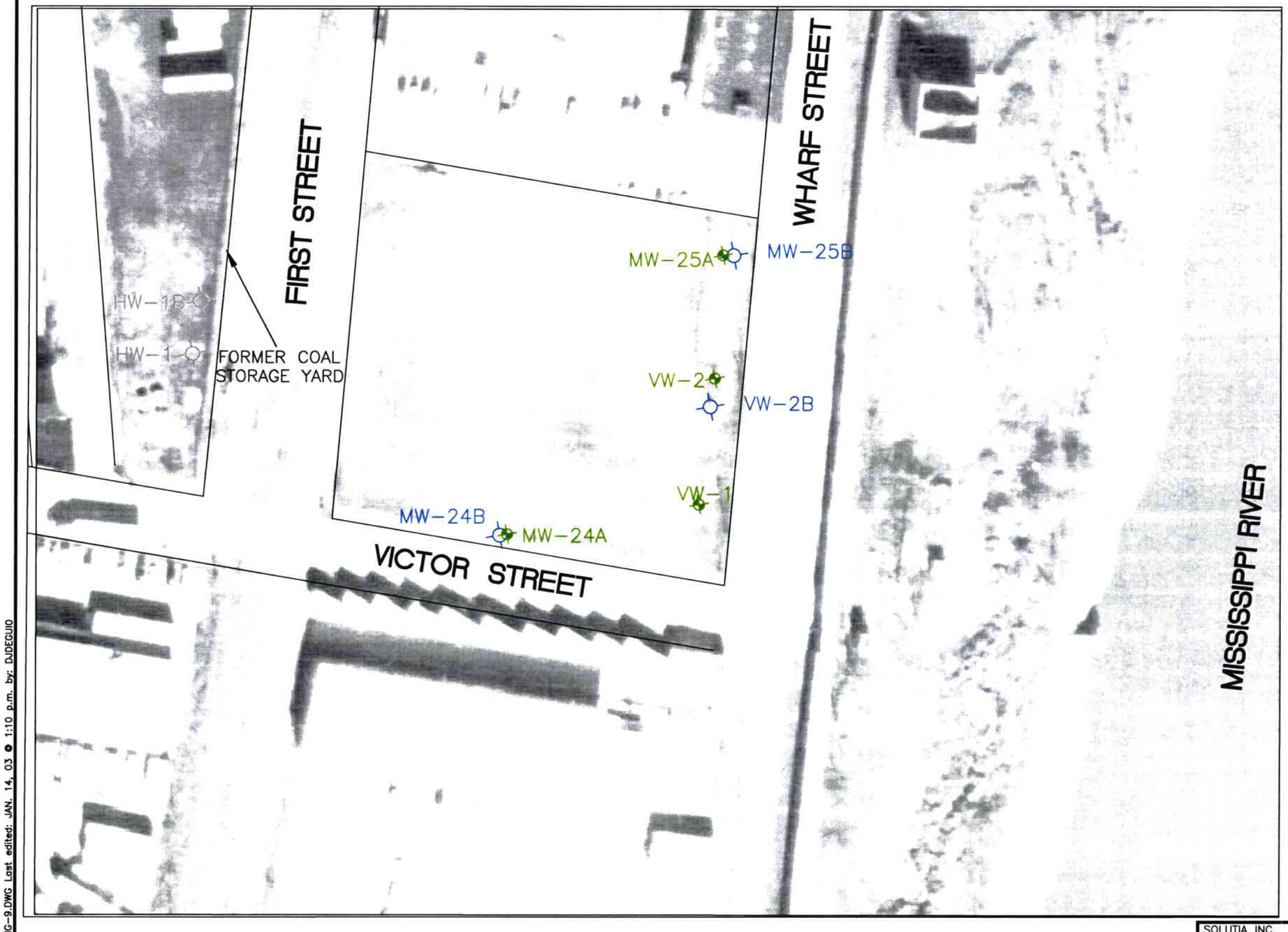
0 80

SCALE FEET

SOURCE: SURDEX AERIAL PHOTO, FLOWN APRIL 6, 2002

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT THE FBSCA WORK PLAN J. F. QUEENY PLANT ST. LOUIS MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY: djd 12/30/02 DSGN. BY: tja CHKD. BY:	Proposed Location of Soil Boring for Soil Property Testing and DNAPL Evaluation	FIG. NO. 8

File: E:\21560870.00013\FIG-8.DWG Last edited: JAN. 14, 03 @ 1:09 p.m. by: DJDEGUIO



LEGEND

- MW-25A WELL SCREENED IN THE FILL & SILTY CLAY TO BE SLUG TESTED (MW-24A, MW-25A, VW-1 AND VW-2)
- MW-24A WELL SCREENED IN THE SAND TO BE SLUG TESTED (MW-24B, MW-25B AND VW-2B)

N

0 80

SCALE FEET

SOURCE: SURDEX AERIAL PHOTO, FLOWN APRIL 6, 2002

SOLUTIA INC. ADDITIONAL DATA COLLECTION AT THE FBSCA WORK PLAN J. F. QUEENY PLANT ST. LOUIS MISSOURI		PROJECT NO. 21560870.00013
URS		
DRN. BY: djd 12/30/02 DSGN. BY: tja CHKD. BY:	Monitoring Well Location Map of Wells to Be Slug Tested	FIG. NO. 9

File: E:\21560870.00013\FIG-9.DWG Last edited: JAN. 14, 03 @ 1:10 p.m. by: DJDEGUIO

APPENDIX A

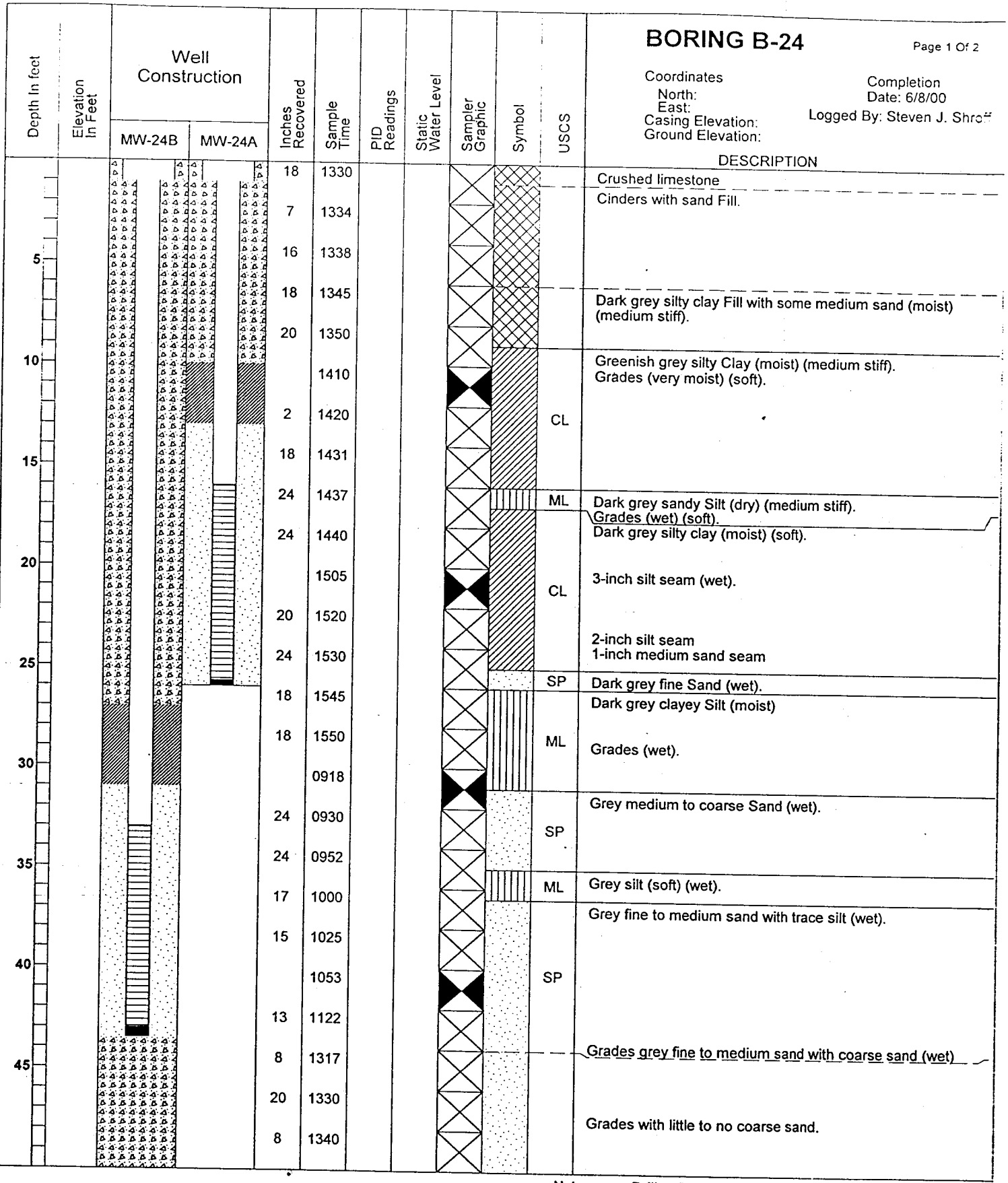
Soil Boring Logs and Monitoring Well Construction Diagrams

BORING B-24

Coordinates
North:
East:
Casing Elevation:
Ground Elevation:

Completion Date: 6/8/00

Logged By: Steven J. Shroff



Notes:

Driller: Roberts Environment
Equipment: CME 75
Method: 4-1/4 & 6-1/4 ID HSA
☒ Split Spoon.
⊠ Hydropunch.
Unified Soil Classification based on field visual observations

URS

LOG OF BORING AND WELL CONSTRUCTION DETAIL

Solutia - John F. Queeny Plant
Second Street, St. Louis, Missouri

Job No. 23-20000058.00

1STL_SOLUTIA2 SOLUT.GPJ URSSTLEV.GDT 10/29/01

BORING B-24

Coordinates
North:
East:
Casing Elevation:
Ground Elevation:

Completion Date: 6/8/00

Logged By: Steven J. Shroff

Depth In feet	Elevation In Feet	Well Construction MW-24B	Well Construction MW-24A	Inches Recovered	Sample Time	PID Readings	Static Water Level	Sampler Graphic	Symbol	USCS	DESCRIPTION
					1420						
				0	1440						Grades with coarse sand and fine gravel.
55				16	1455						
				20	1515						
				14	1530						
60					1610						
				22	0956					SP	
65				24	1010						
				24	1043						
				24	1107						
70					1200						
				0	1337						
75				0							
					1430						
				14							8-inch dark grey Clay seam (moist).
80											Grades with limestone fragments.
											Boring terminated at 82 feet below ground surface due to auger refusal on bedrock. The hole was backfilled with cement/bentonite grout to 43 feet below ground surface and MW-24B was installed at that depth.
85											
90											
95											

Notes:

Driller: Roberts Environment
Equipment: CME 75
Method: 4-1/4 & 6-1/4 ID HSA
☒ Split Spoon.
☒ Hydropunch.
Unified Soil Classification based on field visual observations

URS

LOG OF BORING AND WELL CONSTRUCTION DETAIL

Solutia - John F. Queeny Plant
Second Street, St. Louis, Missouri

Job No. 23-20000058.00

1STL_SOLUTIA2 SOLUT.GPJ URSSTLEV.GDT 10/29/01

MONITORING WELL INFORMATION SHEET
SOLUTIA - JOHN F. QUEENY PLANT

GROUND SURFACE ELEVATION 418.34

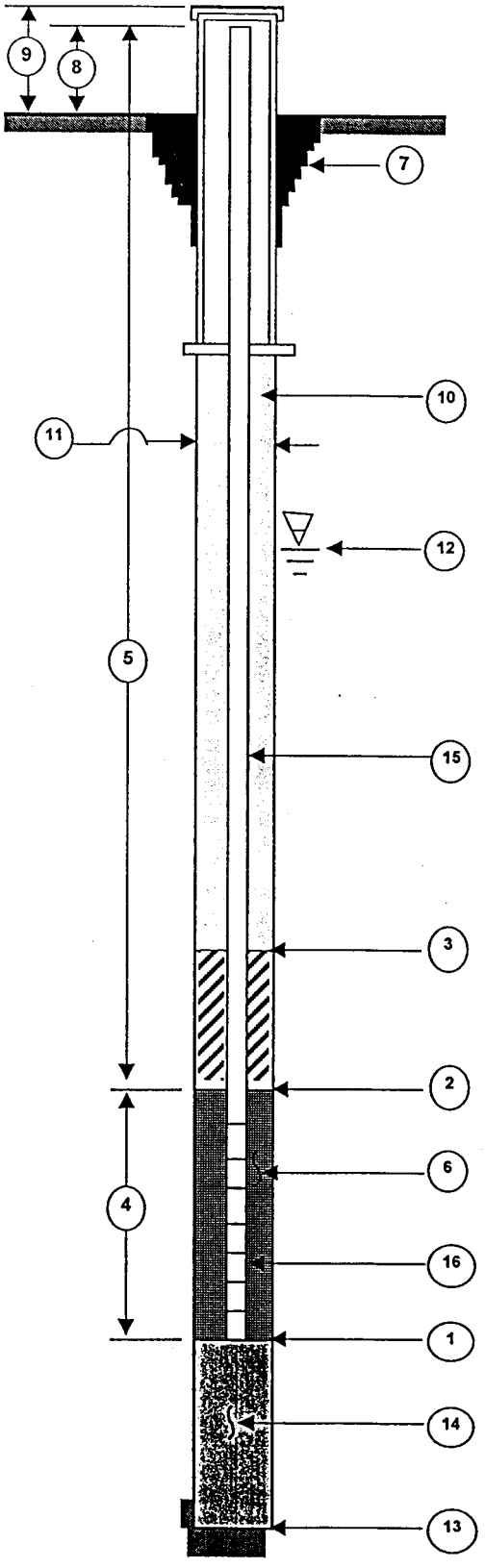
TOP OF INNER WELL CASING ELEVATION 420.80

JOB NUMBER 23-20000058.00

BORING NUMBER MW-24A

INSTALLATION DATE 6/9/2000

LOCATION St. Louis, Missouri



1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 26 FEET.*

2 DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 13 FEET.*

3 DEPTH TO TOP OF SEAL (IF INSTALLED) 10 FEET.*

4 LENGTH OF WELL SCREEN 10 FEET.
SLOT SIZE 0.010 INCHES.

5 TOTAL LENGTH OF RISER PIPE 18.5 FEET AT 4 INCH DIAMETER.

6 TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Silica Filter Sand.

7 CONCRETE CAP? [YES] NO (CIRCLE ONE)

8 HEIGHT OF WELL CASING ABOVE GROUND 2.5 FEET.

9 PROTECTIVE CASIING [YES] NO (CIRCLE ONE)
HEIGHT ABOVE GROUND 2.7 FEET.
LOCKING CAP? [YES] NO (CIRCLE ONE)

10 TYPE OF UPPER BACKFILL Cement/Bentonite Grout.

11 BOREHOLE DIAMETER 11 FEET BELOW TOP.

12 DEPTH TO GROUND WATER - FEET.

13 TOTAL DEPTH OF BOREHOLE 26 FEET.*

14 TYPE OF LOWER BACKFILL N/A.

15 PIPE MATERIAL Schedule 40 PVC.

16 SCREEN MATERIAL Schedule 40 PVC.

* (DEPTH FROM GROUND SURFACE)

MONITORING WELL INSTALLATION DETAILS

URS Corporation

MONITORING WELL INFORMATION SHEET
SOLUTIA - JOHN F. QUEENY PLANT

GROUND SURFACE ELEVATION 418.44

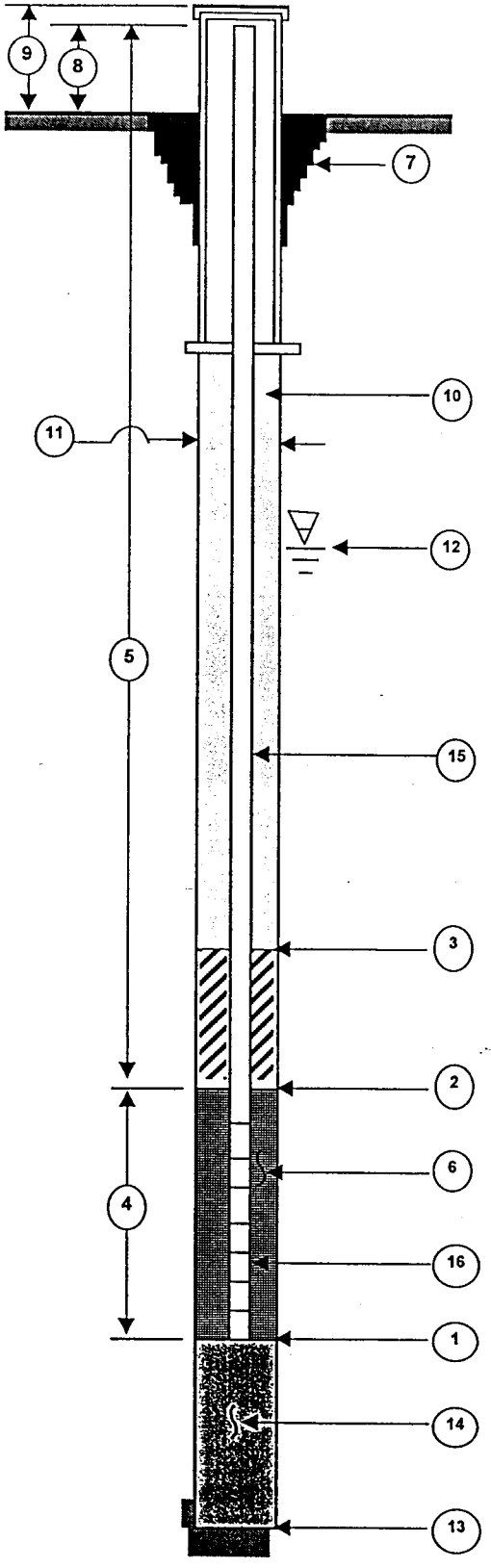
TOP OF INNER WELL CASING ELEVATION 420.84

JOB NUMBER 23-20000058.00

BORING NUMBER MW-24B

INSTALLATION DATE 6/12/2000

LOCATION St. Louis, Missouri



1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 43 FEET.*

2 DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 31 FEET.*

3 DEPTH TO TOP OF SEAL (IF INSTALLED) 27 FEET.*

4 LENGTH OF WELL SCREEN 10 FEET.
SLOT SIZE 0.010 INCHES.

5 TOTAL LENGTH OF RISER PIPE 35 FEET AT 4 INCH DIAMETER.

6 TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Silica Filter Sand.

7 CONCRETE CAP? [YES] NO (CIRCLE ONE)

8 HEIGHT OF WELL CASING ABOVE GROUND 2.5 FEET.

9 PROTECTIVE CASIING [YES] NO (CIRCLE ONE)
HEIGHT ABOVE GROUND 2.7 FEET.
LOCKING CAP? [YES] NO (CIRCLE ONE)

10 TYPE OF UPPER BACKFILL Cement/Bentonite Grout.

11 BOREHOLE DIAMETER 11 FEET BELOW TOP.

12 DEPTH TO GROUND WATER - FEET.

13 TOTAL DEPTH OF BOREHOLE 82 FEET.*

14 TYPE OF LOWER BACKFILL Cement/Bentonite Grout.

15 PIPE MATERIAL Schedule 40 PVC.

16 SCREEN MATERIAL Schedule 40 PVC.

* (DEPTH FROM GROUND SURFACE)

MONITORING WELL INSTALLATION DETAILS

URS Corporation

BORING B-25

Coordinates
North:
East:
Casing Elevation:
Ground Elevation:

Completion Date: 6/14/00

Logged By: Steven J. Shroff

Depth In feet	Elevation In Feet	Well Construction MW-25B	Well Construction MW-25A	Inches Recovered	Sample Time	PID Readings	Static Water Level	Sampler Graphic	Symbol	USCS	DESCRIPTION
				14	1545						Crushed limestone.
				18	1549						Black cinder Fill with fine sand and clay.
5				2	1552						Dark grey silty clay Fill.
				18	1555						Black cinder Fill with fine sand.
				18	1600						Grey silty clay with bricks.
10				2	0911						
				18	0914	94.6					Grey clayey Silt (moist) (soft).
15				12	0918	415				ML	
				2	0920						
				19	0929	>2000				CL	Grey silty Clay (moist).
20				12	0935	>2000					Grey fine Sand (dry).
				12	0940					SP	Grades (wet).
				24	0946						Grey clayey Silt (moist).
25				18	1036	9.2				ML	Grades (wet).
				14	1039						Grades with fine Sand (moist).
30				12	1053						Brown with white and black medium Sand (wet).
				15	1059						
				17	1103						6-inch grey Silt seam (wet).
35					1133						Brown medium sand (wet).
				15	1330						
40				24	1338						
				24	1348						Grades with trace coarse sand.
				18	1409					SP	Grades grey.
45					1430						
					1500						

Notes:
Driller: Roberts Environment
Equipment: CME 75
Method: 4 1/4 ID HSA
☒ Split Spoon.
☒ Hydropunch.
Unified Soil Classification based on field visual observations

URS

LOG OF BORING AND WELL CONSTRUCTION DETAIL

Solutia - John F. Queeny Plant
Second Street, St. Louis, Missouri

Job No. 23-20000058.00

1STL_SOLUTIA_SOLUT.GPJ URSSTLEV.GDT 10/29/01

BORING B-25

Coordinates
North:
East:
Casing Elevation:
Ground Elevation:

Completion Date: 6/14/00
Logged By: Steven J. Shroff

Depth In feet	Elevation In Feet	Well Construction MW-25B	Well Construction MW-25A	Inches Recovered	Sample Time	PID Readings	Static Water Level	Sampler Graphic	Symbol	USCS	DESCRIPTION
				24	1514						6-inch grey, sandy Silt seam (wet).
				21	1525						
55				24	1540					CL	Grey, silty Clay with fine sand (moist).
					1557						Grey, sandy Silt (wet).
				24	1625						
60				9	0944						
				12	1005						Grades with trace coarse sand.
65				0	1023						
					1045						
				9	1125					SP	
70				8	1340						Grey, fine sand (wet).
				0	1400						
75				7	1420						
					1455						Grey, fine to medium sand (wet).
				24	1600						
80					1615						Grades with gravel.
											Boring terminated at 81.0 feet below ground surface due to auger refusal on bedrock. The hole was backfilled with cement/bentonite grout to 45 feet below ground surface and MW-25B was installed at that depth.
85											
90											
95											

Notes:
Driller: Roberts Environment
Equipment: CME 75
Method: 4 1/4 ID HSA
☒ Split Spoon.
☒ Hydropunch.
Unified Soil Classification based on field visual observations

URS

LOG OF BORING AND WELL CONSTRUCTION DETAIL

Solutia - John F. Queeny Plant
Second Street, St. Louis, Missouri

Job No. 23-20000058.00

1STL_SOLUTIA_SOLUT.GPJ URSSTLEV.GDT 10/29/01

MONITORING WELL INFORMATION SHEET
SOLUTIA - JOHN F. QUEENY PLANT

GROUND SURFACE ELEVATION 417.14

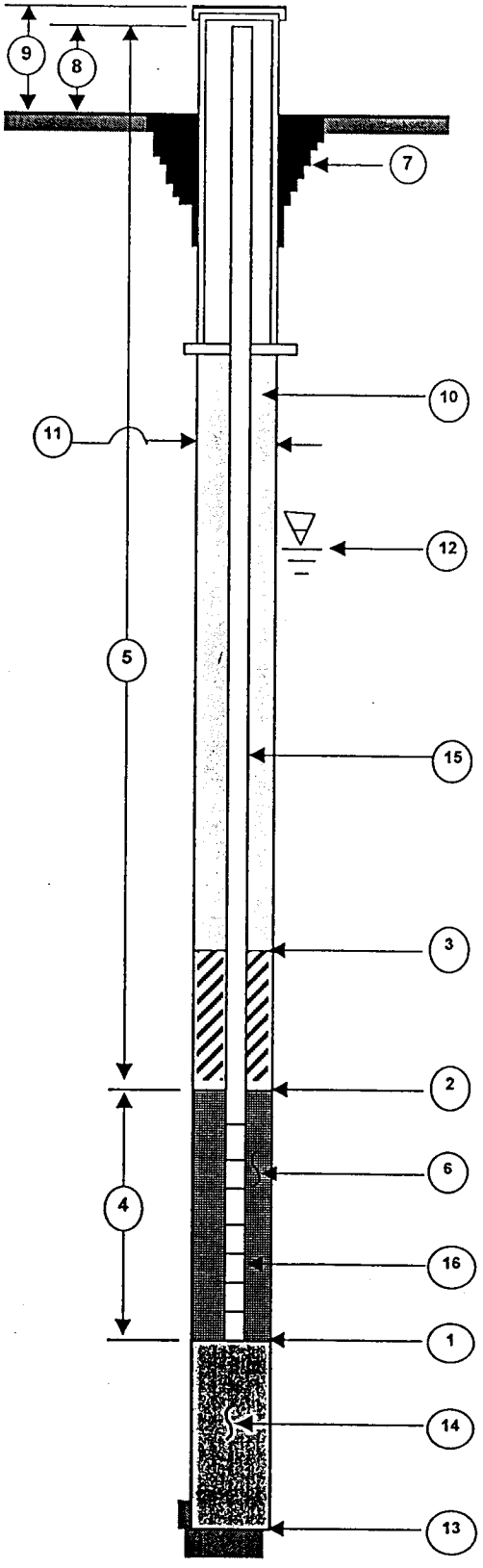
TOP OF INNER WELL CASING ELEVATION 419.90

JOB NUMBER 23-20000058.00

BORING NUMBER MW-25A

INSTALLATION DATE 6/15/2000

LOCATION St. Louis, Missouri



1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 28 FEET.*

2 DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 16 FEET.*

3 DEPTH TO TOP OF SEAL (IF INSTALLED) 12.5 FEET.*

4 LENGTH OF WELL SCREEN 10 FEET.
SLOT SIZE 0.010 INCHES.

5 TOTAL LENGTH OF RISER PIPE 20.5 FEET AT 4 INCH DIAMETER.

6 TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Silica Filter Sand.

7 CONCRETE CAP? [YES] NO (CIRCLE ONE)

8 HEIGHT OF WELL CASING ABOVE GROUND 2.5 FEET.

9 PROTECTIVE CASIING [YES] NO (CIRCLE ONE)
HEIGHT ABOVE GROUND 2.7 FEET.
LOCKING CAP? [YES] NO (CIRCLE ONE)

10 TYPE OF UPPER BACKFILL Cement/Bentonite Grout.

11 BOREHOLE DIAMETER 11 FEET BELOW TOP.

12 DEPTH TO GROUND WATER - FEET.

13 TOTAL DEPTH OF BOREHOLE 28 FEET.*

14 TYPE OF LOWER BACKFILL N/A.

15 PIPE MATERIAL Schedule 40 PVC.

16 SCREEN MATERIAL Schedule 40 PVC.

* (DEPTH FROM GROUND SURFACE)

MONITORING WELL INSTALLATION DETAILS

URS Corporation

MONITORING WELL INFORMATION SHEET
SOLUTIA - JOHN F. QUEENY PLANT

GROUND SURFACE ELEVATION 417.14

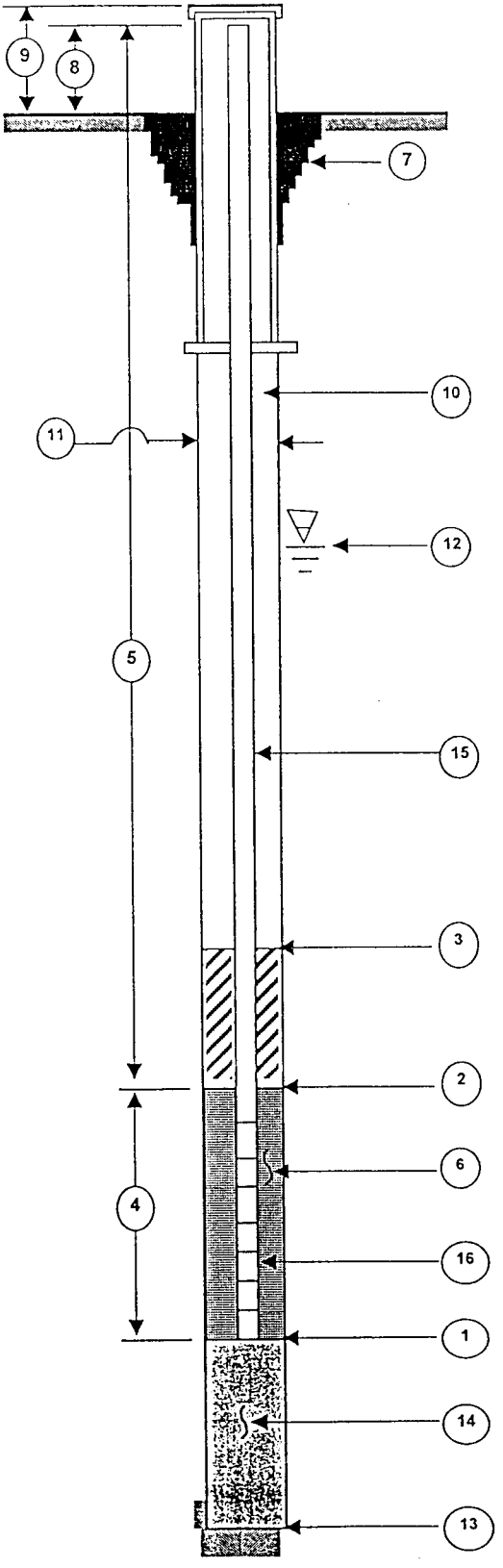
TOP OF INNER WELL CASING ELEVATION 419.99

JOB NUMBER 23-20000058.00

BORING NUMBER MW-25B

INSTALLATION DATE 6/16/2000

LOCATION St. Louis, Missouri



1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 45 FEET.*

2 DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 30 FEET.*

3 DEPTH TO TOP OF SEAL (IF INSTALLED) 26 FEET.*

4 LENGTH OF WELL SCREEN 10 FEET.
SLOT SIZE 0.010 INCHES.

5 TOTAL LENGTH OF RISER PIPE 37.5 FEET AT 4 INCH DIAMETER.

6 TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Silica Filter Sand

7 CONCRETE CAP? [YES] NO (CIRCLE ONE)

8 HEIGHT OF WELL CASING ABOVE GROUND 2.5 FEET.

9 PROTECTIVE CASING [YES] NO (CIRCLE ONE)
HEIGHT ABOVE GROUND 2.7 FEET.
LOCKING CAP? [YES] NO (CIRCLE ONE)

10 TYPE OF UPPER BACKFILL Cement/Bentonite Grout

11 BOREHOLE DIAMETER 11 FEET BELOW TOP.

12 DEPTH TO GROUND WATER - FEET.

13 TOTAL DEPTH OF BOREHOLE 81 FEET.*

14 TYPE OF LOWER BACKFILL Cement/Bentonite Grout

15 PIPE MATERIAL Schedule 40 PVC

16 SCREEN MATERIAL Schedule 40 PVC

* (DEPTH FROM GROUND SURFACE)

MONITORING WELL INSTALLATION DETAILS

URS Corporation

GERAGHTY & MILLER, INC.

SAMPLE/CORE LOG

BORING/WELL: VW-1 PROJECT NO: Monsanto Queeny NY0308QU04 PAGE: 1 of 2

SITE LOCATION: St. Louis, MO DRILLING STARTED: 5/23/88 DRILLING COMPLETED: 5/24/88

TOTAL DEPTH DRILLED: 70.75 ft HOLE DIAMETER: 6 inches TYPE OF SAMPLE/ CORING DEVICE: Split-Barrel Core

LENGTH & DIAMETER OF CORING DEVICE: 2 feet/ 1 1/2 inches SAMPLING INTERVAL: continuous/5 feet

LAND-SURFACE ELEVATION: ( ) SURVEYED ( ) ESTIMATED DATUM:

DRILLING FLUID USED: None DRILLING METHOD: Hollow-Stem Auger (CME-75)

DRILLING CONTRACTOR: John Mathes & Associates, Inc. DRILLER: C. Whistle HELPER: C. Harriss

PREPARED BY: B. Blum HAMMER WEIGHT: 140 lbs. HAMMER DROP: 30 inches

SAMPLE DEPTH (FT BELOW LAND SURFACE)		CORE RECVRY (FT)	BLOW COUNTS PER 6 INCHES	SAMPLE/CORE DESCRIPTION
FROM	TO			
0	2		Grab	Fill: mixture of sand, silt and gravel below a crushed
				stone cover.
2	4	1.5	2-1-1-1	Fill: cinder, black with sand, fine with silt and 25-30%
				gravel stained brown to black (possibly petroleum
				hydrocarbon?) loose.
4	6	1.5	2-1-1-1	Same as above.
6	8	1.0	1-0-0-1	Same as above - wet at 6.5 feet.
8	10	0.75	1-1-1-1	Same as above.
10	12	1.0	2-1-5-2	Fill: cinder grading into silt and clay. Piece of rock
				was lodged in core barrel shoe.
12	14		2-1	Silt and clay, gray.
14	16	2.0	1-1-1-2	Silt, gray grading into clay, gray at 15 feet.
19	21	2.0	5-7-5-5	Silt grading into fine sand lens well sorted (0.5 feet)
				grading to fine sand and silt mixture.
24	26	2.0	2-1-2-1	Silt, clay, and sand, very fine, olive gray.
29	31	2.0	6-16-13-	Sand, coarse, gray and assorted grain colors with 0.2
			18	feet silt seam in shoe of spoon.
34	36	2.0	4-6-5-13	Sand, medium to coarse with some silt (5%).
39	41	---	5-9-10-	No recovery (remnant sand, coarse).
			15	
44	46	---	5-7-11-	No recovery - probably fine sands.
			13	

GERAGHTY & MILLER, INC.

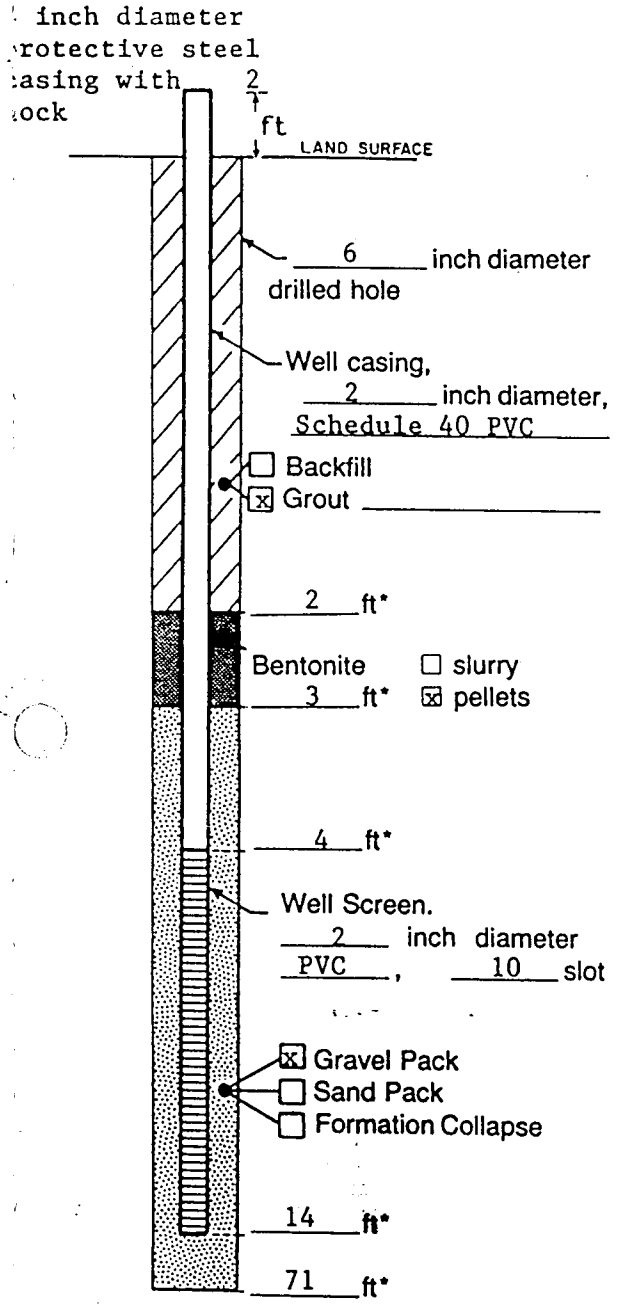
SAMPLE/CORE LOG (Cont.d)

BORING/WELL: VW-1 PREPARED BY: B. Blum PAGE: 2 of 2

SAMPLE DEPTH (FT BELOW LAND SURFACE)		CORE RECVRY (FT)	BLOW COUNTS PER 6 INCHES	SAMPLE/CORE DESCRIPTION
FROM	TO			
49	51	2.0	2-4-6-12	Sand, medium to coarse, brown, grading sharply (at 50
				feet) into sand, very fine and silt (50%) gray.
54	56	2.0	1-3-5-6	Sand, medium to coarse, gray with assorted grain colors.
59	61	2.0	5-5-8-8	Sand, coarse, with gravel (20%), gray and assorted grain
				colors.
64	66	2.0	5-5-7-10	Sand, medium, gray and tan.
5/24/88				
69	71	1.75	8-25-41-	Same as above, grading into sand, medium with 20% gravel
			92+	and lignite (?). Refusal at 70.75 feet with chips of
				limestone rock lodged into shoe of core barrel.

GERAGHTY & MILLER, INC.
Ground-Water Consultants

WELL CONSTRUCTION LOG
(UNCONSOLIDATED)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

*Depth Below Land Surface

Project Monsanto Queeny/NY0308QU04 Well VW-1

Town/City St. Louis

County St. Louis State Missouri

Permit No. _____

Land-Surface Elevation

and Datum 417.19 feet ☒ Surveyed

MSL ☐ Estimated

Installation Date(s) 5/24/88

Drilling Method Hollow Stem Auger (CME-75)

Drilling Contractor John Mathes & Associates, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)

Surging with compressed air on 5/27/88

Fluid Loss During Drilling None gallons

Water Removed During Development 25 gallons

Static Depth to Water 8.74 on 5/25/88 feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration 2 hours

Yield 1/4 gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose Ground Water Monitoring

Remarks

Prepared by B. Blum

GERAGHTY & MILLER, INC.

SAMPLE/CORE LOG

BORING/WELL: VW-2 PROJECT NO: Monsanto Queeny NY0308QU04 PAGE: 1 of 1

SITE LOCATION: St. Louis, MO DRILLING STARTED: 5/24/88 DRILLING COMPLETED: 5/24/88

TOTAL DEPTH DRILLED: 16 feet HOLE DIAMETER: 6 inches TYPE OF SAMPLE/ CORING DEVICE: Split-Barrel Core

LENGTH & DIAMETER OF CORING DEVICE: 2 feet/ 1 1/2 inches SAMPLING INTERVAL: continuous/5 feet

LAND-SURFACE ELEVATION: ( ) SURVEYED ( ) ESTIMATED DATUM:

DRILLING FLUID USED: None DRILLING METHOD: Hollow-Stem Auger (CME-75)

DRILLING CONTRACTOR: John Mathes & Associates, Inc. DRILLER: C. Whistle HELPER: D. Gotto

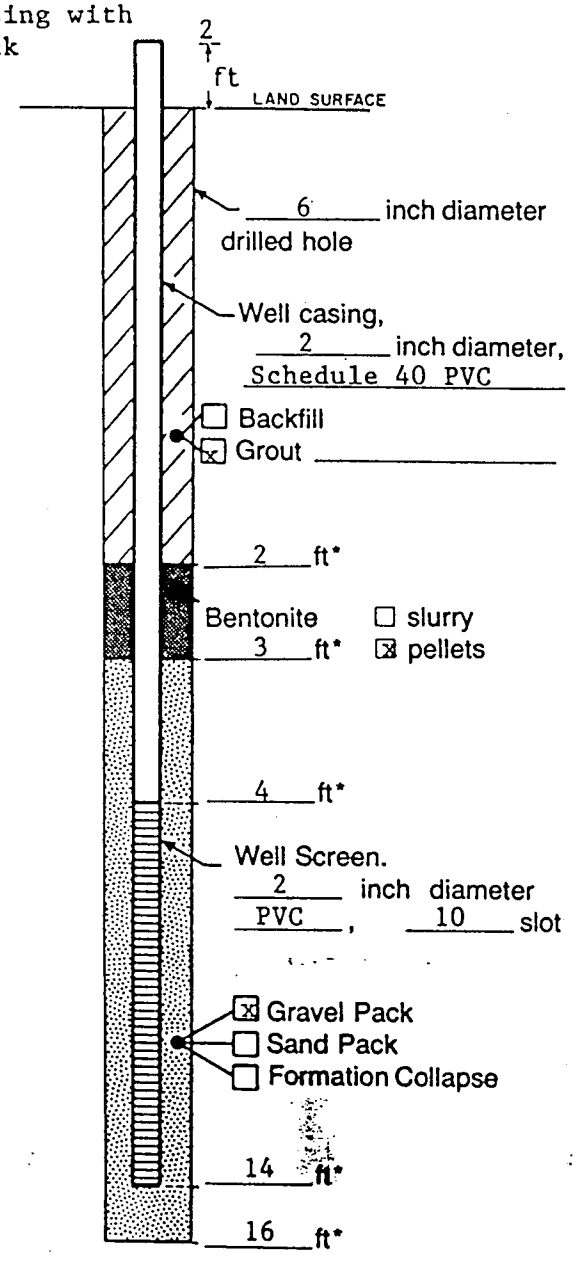
PREPARED BY: B. Blum HAMMER WEIGHT: 140 lbs. HAMMER DROP: 30 inches

SAMPLE DEPTH (FT BELOW LAND SURFACE)		CORE RECVRY (FT)	BLOW COUNTS PER 6 INCHES	SAMPLE/CORE DESCRIPTION
FROM	TO			
0	2		Grab	Fill: silt, sand, fine, brown; organic debris.
2	4	0.5	2-1-1-3	Fill: sand, fine, brown with organic debris.
4	6	0.75	1-1-2-2	Fill: fine, silt, resinous texture with cinder.
6	8	2.0	1-1-2-2	Same as above, grading into silt (resinous black stain).
8	10	1.0	2-1-1-1	Fill: Silt and clay (resinous black stain).
10	12	2.0	2-3-5-5	Fill: cinder and gravel with resinous stain. Grading
				into silt, gray (no staining).
12	14	2.0	4-3-3-2	Silt and clay, gray.
14	16	2.0	1-1-2-1	Silt and clay, gray (same as above).

GERAGHTY & MILLER, INC.
Ground-Water Consultants

WELL CONSTRUCTION LOG
(UNCONSOLIDATED)

inch diameter
rotective steel
asing with
ock



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

*Depth Below Land Surface

Project Monsanto Queeny/NY0308QU04 Well VW-2
Town/City St. Louis
County St. Louis State Missouri
Permit No. _____
Land-Surface Elevation
and Datum 417.42 feet ☒ Surveyed
MSL ☐ Estimated
Installation Date(s) 5/24/88
Drilling Method Hollow Stem Auger (CME-75)
Drilling Contractor John Mathes & Associates, Inc.
Drilling Fluid None

Development Technique(s) and Date(s)
Surging with compressed air on 5/27/88

Fluid Loss During Drilling None gallons
Water Removed During Development 25 gallons
Static Depth to Water 9.34 on 5/25/88 feet below M.P.
Pumping Depth to Water _____ feet below M.P.
Pumping Duration 2 hours
Yield 1/4 gpm Date _____
Specific Capacity _____ gpm/ft
Well Purpose Ground Water Monitoring

Remarks

Prepared by B. Blum

G&M Form 05 5-87

Southpoint 87-1776